ABSTRACT

DEVALOIS, JOSIAH JOHN. Analyzing the Cost of Separation: Financial Insights into US Air Force Pilot Retention. (Under the direction of Russell E. King and Brandon M. McConnell).

The US Air Force has a pilot retention problem, and Air Force pilots have a separation decision problem. Thousands of pilots choose to separate from the military each year after their initial service obligation. This costs the Air Force millions of dollars in annual training to replace the separated pilots. Many leave because they want greater agency in where they live, when they work, and other things, but a some leave because they think they can earn more money flying for a major civilian airline.

Airline pilots can, in fact, earn over $350k per year, but it takes many years to get to that point. Pilots must first get promoted to Captain after serving as a first officer for around seven years. As a result, pilots leaving the Air Force need to take a temporary pay cut in their initial year working for an airline. Additionally, Air Force pilots earn a large portion of their income tax-free as part of their military compensation package and qualify for a generous pension to be paid immediately following separation after 20 or more years of service.

This paper analyzes a pilot's separation decision from multiple viewpoints in terms of financial success. Through numerical experimentation, various scenarios are constructed that account for varying promotions, investment returns, costs of living, retirement plans, and other factors. The analysis uses three financial success metrics to show the effects of a pilot's separation decision for the immediate future (a myopic view), throughout a career (value-at-retirement), and over a lifetime (lifetime earnings). Additionally, varying the parameters that some pilots may have allows the model not to generalize the pilot's situations but to adapt to them to show how different factors can affect the pilot's financial situation and the incentives for timing separation. The results show that pilots electing to stay in long enough to secure a pension can earn up to 33% more over a lifetime than their counterparts who separate after their active duty service commitment. While it might make sense for pilots to leave the Air Force because of lifestyle preferences, separating pilots take a pay cut, and the military should communicate that clearly and effectively if it wants to retain its pilots and save money on training costs.

Analyzing the Cost of Separation: Financial Insights into US Air Force Pilot Retention

by
Josiah John DeValois

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APPROVED BY:

Russell E. King Co-chair of Advisory Committee	Brandon M. McConnell Co-chair of Advisory Committee
Donald Warsing	Semra Şebnem Ahıska King

L. Matthew Doudnikoff

DEDICATION

To my mom, for cultivating in me the importance of learning.

BIOGRAPHY

Josiah was born and raised in central Iowa. After high school, he attended the US Air Force Academy, where he commissioned as an Operations Research Officer in the US Air Force. Upon graduation, he will move to Louisiana, where he will be a flight test analyst at Barksdale AFB.

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The views expressed in this paper are those of the author and do not reflect the official policy or position of the United States Air Force, the Department of Defense, or the United States Government.

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CHAPTER

1

INTRODUCTION

1.1 Background

Pilots in the US Air Force (USAF) are committed to ten years of active duty service commitment (ADSC) after undergraduate pilot training (UPT) (US Air Force 2024b). A pilot trainee typically finishes UPT after two years of service when factoring in the time they spend awaiting pilot training, thus making the total commitment 12 years from commissioning. A pilot can stay in or separate from the Air Force after completing their initial ADSC. If the pilot decides to stay in military service and incur additional time in ADSC, they will have to make the same decision again at a future date once that ADSC expires. Each year, the Air Force offers pilots of particular aircraft an opportunity for an additional bonus by extending their ADSC. However, this paper does not consider those bonuses, as part of its objective is to identify their proper size. If pilots separate from the military after 20 or more years of service, they earn a pension equal to a proportion of their base pay. USAF pilots need to decide whether it is worth it to stay in and secure a pension or separate to secure a lucrative airline career.

Thus, pilots need information on how long they should stay in the military to make the correct decision at each point when they can decide whether to extend their active duty service commitment or separate from the Air Force. Knowing beforehand how long they plan to stay in the military benefits pilots, resulting in not having to analyze at each point but knowing from

the beginning of their careers what the financial implications of specific career lengths are.

In 2020, the Air Force was short 2100 pilots, 1300 of whom would have been fighter pilots (Switzer 2020). This shortage is primarily driven by separations immediately following pilots' initial 10-year ADSC, which begins upon completion of UPT.

According to a 2020 exit survey, pilots leaving the Air Force are not satisfied with their compensation, and leaving the Air Force leads to better financial outcomes. Under this rationale, the analysis leads to a clear decision: leave the military as soon as possible to pursue better compensation and a higher quality of life. The problem with this rationale is that it is not entirely clear that individuals have good information about how their compensation compares to airline pilots' compensation. For example, active duty pilots may know senior airline captains can make more than $350k annually. However, they may not be aware that their pay initially decreases upon starting for an airline as they are first year first officers.

Taste for military lifestyle significantly impacts whether pilots choose to stay in the military or leave. Pilots without a taste for the military perceive that staying in is not only a sacrifice of preference but also a financial sacrifice. Many pilots who enjoy the military lifestyle believe they get to stay in the military and continue to enjoy it at the expense of some economic success. This sentiment may only sometimes be accurate. For pilots to make savvy, informed decisions, they ought to have the data that indicates how much it will cost them to stay in or leave the military and consider that with their preferences. While economic criteria alone will convince few people to stay or separate, it is a critical component of an important decision that pilots should understand before making a decision.

Because this paper looks at finances alone, it cannot determine the correct decision for everyone holistically, but it can illuminate the rationale for pilots' decisions. For example, suppose pilots act out of line with the financial decisions that would be optimal for them. In that case, it may indicate that quality of life or career preference decisions impact their decisions and can balance out the financial incentive.

In the military, pilots are paid based on time in service and rank; this constitutes the pilot's base pay, which is regular, taxable pay. In addition, pilots receive a basic allowance for housing (BAH) and a basic allowance for subsistence (BAS). BAH varies with the cost of rent for "adequate housing," and BAS is fixed to a set monthly payment (Congressional Budget Office 2024). Neither BAH nor BAS is taxable income (Congressional Budget Office 2024). If a military member separates after over 20 years of service, they are immediately entitled to a pension equal to a proportion of their highest three years of base pay. The years of service and the retirement plan determine this proportion. Under the Blended Retirement System (BRS), the member receives 2% times the number of years of service times the average of the highest-paying three years. Under the High-36 Retirement System, this increases to a 2.5%

multiplier (US Department of Defense 2024).

Civilian pilots are paid based on rank and years in rank. However, the airlines have only two ranks: first officer and captain. After twelve years in either rank, the pay maxes out and only increases with inflation. Airlines incentivize their pilots not to depart from their current airline for a different airline, as they would need to start back as first-year first officers (Mattock et al. 2016). Likewise, a military pilot starting at an airline starts as a first-year first officer, regardless of flying experience. After around seven years, the airline promotes its first officers to captains. The more senior an airline pilot is, the more choice he has in the plane and the hours he will fly. First-year first officers and captains more likely to fly narrow-body planes during non-preferred hours and on weekends and holidays (Mattock et al. 2016).

1.2 Research Questions

This thesis explores the following research questions:

RQ1 When should a pilot exit the USAF to maximize lifetime earnings?

RQ2 When should a pilot leave the USAF to maximize accumulated wealth at the time of retirement?

RQ3 How much would the USAF need to increase compensation to compete with airlines financially?

This paper will show the monetary incentives pilots face each year for whether they should stay in an additional year or get out. One key aspect of this paper is that it is not geared only towards how the Air Force can make pilots stay in, but also towards pilots and informing their career decisions. Suppose pilot behavior is not indicative of the apparent incentive structure. In that case, we will analyze the possible explanations for the interaction between incentives and actions, and explore what the Air Force can do to change it.

1.3 Literature Review

Many papers have recommended non-financial solutions to pilot retention, including but not limited to better leadership, empowered squadron commanders, a more manageable operations tempo, improved culture, and renewed warrior ethos (Schwartz 2017; Schulker and Terry 2018; Voisin 2021; Gray 2019; Ahn et al. 2023; Trodahl 2020; Maulsby 2019). Others have suggested a combination of those or other quality-of-life type factors (Bell 2017; Bressett 2018;

Stahl 2014; McKenzie 1999; McCracken 2021; Coughlan et al. 2011; Switzer 2020; Kafer 1998). Still, others recommend changes regarding the size, timing, and context of the Aviation Bonus (AvB), with consistent findings that an increased AvB would improve retention (Asch and Hosek 1999; Calkins et al. 2023; Mattock et al. 2016).

In analyzing groups more likely to separate before retirement, both Canpolat and Gültekin (2010) and Lu (1995) find that women and minorities, as well as other groups are highest risk. Additionally, using simple machine learning techniques, Ahn et al. (2023) discover that individuals can be identified as being particularly at-risk of separation and use this as a basis for an argument that incentives should be more personalized to individuals of the at-risk of separation groups. Other recent studies review factors that seem to cause pilot retention problems for women in the Air Force (Nussrat 2024; Astudillo 2021). Lytell et al. (2023) analyze discrepancies in race-based retention in the US Army, and discusses some possible causes and solutions for specific issues pertaining to it.

The literature surrounding the Air Force pilot retention problem focuses on the issue from a macroscopic point of view . Many researchers have written about ways to keep pilots in the Air Force longer, researched demographic trends in pilot retention, proposed solutions to increase career satisfaction, and looked at the economic viability of increased aviator bonuses (Mattock et al. 2016, 2019; Kafer 1998; Switzer 2020; Asch and Hosek 1999; Asch et al. 2020; Calkins et al. 2023; Faris 1984; Lu 1995; Mann 2012; Maulsby 2019; McCracken 2021; Schulker and Terry 2018; Schwartz 2017; Tong et al. 2021, 2020; Trodahl 2020). However, the literature lacks a rigorous analysis of the financial incentives a pilot faces when deciding to stay in the Air Force or separate. If the Air Force accurately understands the economic incentives pilots face, it can be better informed in its decisions and communication surrounding pilot retention.

In a 2020 exit survey, pilots declared that their top reasons for leaving were poor work-life balance, lack of choice in assignments, additional non-flying duties, availability of civilian jobs, and dissatisfaction with overall compensation (Switzer 2020). Some non-financial factors affect pilot career decisions. Still, it would make sense for pilots to clearly understand the financial trade-off between the qualitative complaints with the military, such as work-life balance, and the financial upside. Many people are willing to accept some non-preferred aspects of a career if it means high wages and benefits. Pilots who elect to stay rank compensation among the top five reasons for deciding to stay, illuminating the lack of consensus on the fairness of pilots' pay (Strength 2020). So pilots who elect to separate from the military think that they are not being compensated enough, and pilots who elect to remain think they are being compensated fairly (Strength 2020).

When pilots decide to stay in the military after their initial commitments, over 20% stop flying, so the gripe for too many non-flying duties seems justified. Switzer (2020) proposes

three changes: 1) empower squadron commanders, 2) offer a bonus earlier, and 3) offer additional service commitment for getting a preferred assignment. By empowering squadron commanders, he means that the Air Force should make the offer of the aviation bonus more personal, with a commander offering the bonus, rather than submitting a response via an impersonal email. To offer a bonus earlier, Switzer recommends something like what the US Army does, offering an incentive such as paying for grad school in exchange for an additional service commitment. His final recommendation is to offer an additional service commitment to pilots who opt into getting a higher preference for base locations and aircraft assignments following UPT. If the Air Force did these things, Switzer (2020) argues, more pilots would be willing to take the aviator bonus in exchange for a longer active duty service commitment. Only 45% of pilots take the bonus following their initial active duty service commitment, but the Air Force aims for a 65% acceptance rate. By implementing these changes, the acceptance rate may be higher. However, if pilots had a better general understanding of the value of their salaries compared to airline pay, they would have more information regarding whether it is financially wise to take the aviator bonus and associated ADSC.

Another relevant question is whether it is financially worth it for the Air Force to offer the aviation bonus. One paper looked at three models to see if the Aviator bonus is an economically viable option to keep pilots in the Air Force rather than training new pilots (Stone et al. 1989). These models compare the costs of training a new pilot with the cost of retaining one. In all three of their models, they found that offering a bonus to trained pilots is less expensive than training new pilots to replace experienced ones. Mattock et al. (2019) also evaluate this and find that it is financially efficient for the USAF to retain pilots instead of accessing new ones through training. Training new pilots can cost as much as nearly 11 million dollars per pilot, so financially, it makes sense for the Air Force to retain already trained pilots (Mattock et al. 2019). Mattock et al. (2019) find that offering an aviation bonus of up to at least $100k annually would minimize the Air Force's annual per capita pilot costs by increasing retention. However, if the Air Force decided to do this, it would have a far more experienced force with a higher annual pay bill and lower training costs. If the Air Force were okay with a much more experienced force, however, then financially, it would make sense to keep the aviator bonus high. A lower aviator bonus, on the other hand, would result in a less experienced force, a lower pay bill, and higher annual training costs. These studies prove that the aviator bonus is effective at retaining pilots and cost-effective for the Air Force.

Mattock et al. (2016) also examine the ramifications of eliminating the AvB. They find that there would be a 1% decrease in retention. This same paper looks at the salaries of airline pilots and calculates the present discounted value of civilian earnings for pilots who are considering leaving. This study does not include an analysis of the pilot's current military pay or the certainty

that a military pilot will have in his or her civilian pay prior to separation. Because a military pilot can apply for jobs before separation, he can know his pay as an airline pilot. He will be more likely to compare his present pay to his future pay if he gets out rather than use an expected value.

To pay pilots a higher aviation bonus, the Air Force needs to seek approval from Congress, as it did to get approval for an aviation bonus of up to $50,000 per year (Bacon 2022). General Goldfein said in a statement in 2016 that "pilots stay [in the Air Force] because they want to work with the most amazing people, with the greatest technology, to have a mission that matters, and give their life meaning… and that's the value proposition" (Switzer 2020). Switzer (2020) doubles down on this and says, "[t]he Air Force could never compete for pilot talent on financial terms alone," but this paper seeks to find if these assertions can be proven.

A number of studies explore more specifically why people leave the Air Force (Dulce II 2024; Zais and Zhang 2016; Bressett 2018; Stahl 2014; Tong et al. 2021, 2020; Faris 1984; Gray 2019; Trodahl 2020; Mann 2012; Schofield et al. 2018). Many examine the military pay structure generally to see how it incentivizes military personnel (Ausink and Wise 2007; Hosek et al. 2019; Zais and Zhang 2016; Asch et al. 2023; Tong et al. 2020; Faris 1984; Asch and Hosek 1999; Joffrion and Wozny 2015; Asch et al. 2020). But only three look at the military separation decision from the pilot's perspective (Zais and Zhang 2016; Gotz and McCall 1983; Hodges 2015).

Zais and Zhang (2016) and Gotz and McCall (1983) offer a very similar approach to the questions this paper seeks to answer by using dynamic programming approaches to analyze military retention. Zais and Zhang (2016) analyze the US Army's enlisted force and formulate a dynamic program in which enlisted service members have certain probabilities of earning more money after separating from the military. This problem is distinctly different from pilot separation because these members are primarily junior since they did not incur a long active duty service commitment from pilot training. Additionally, these service members transfer into far more diverse career fields than USAF pilots do, so post-separation pay contains far more variance. Gotz and McCall (1983) study the sequencing of pay structures in the USAF to analyze a policy proposal from 1983 with a dynamic programming approach. This framework is effective at analyzing decision incentives for USAF Officers in general, but does not investigate the incentives for USAF pilots specifically. It finds that it is financially optimal for Air Force officers to stay in military service at least until retirement eligibility at 20 years of service. It does not look specifically at all of the details and situations, but generalizes from data from that time. This paper is similar, but it contains updated data, considers a variety of scenarios, and focuses on pilots specifically.

This paper builds primarily on Hodges (2015) analysis of the military pilot separation problem. Hodges (2015) provides a good description of the situation pilots face when deciding

to stay in the military or leave, and finds that pilots benefit financially from staying in the military until at least 20 years of service instead of separating after their initial active duty service commitment. He used an ADSC of 8 years instead of the current 10, and used net present value as well as lifetime earnings to determine career values. The biggest difference between his work and this work is in the models used and in the assumptions made. Hodges (2015) looks at one specific scenario, while this work varies a lot of the parameters that he assumes are the same for everyone such as location, marital status, promotion, etc. Further, some data has changed since it was published, and this paper uses a different model which includes interest earned.

The literature consistently finds it is nearly always financially efficient for the Air Force to offer a high aviator bonus (Mattock et al. 2019; Stone et al. 1989). If the Air Force could advertise that it would provide a financial package equivalent to the value of switching to a civilian airline, it would provide more incentive for pilots to stay in and save the Air Force money (Mattock et al. 2019).

CHAPTER

2

METHODOLOGY

This research develops three distinct approaches to address this problem. First, it employs a myopic approach in which a pilot looks only at his or her following year of earnings. Next, it seeks to maximize lifetime earnings and savings at the time of retirement. Many parameters unique to a pilot's situation can affect these results.

2.1 Data

The data for this analysis comes from publicly available sources. The Air Force pay charts are public information, as are their BAH tables and BAS rates (US Air Force 2024a). Income taxes are available from the IRS, and United Airlines pay charts are available online (Airline Pilot Central 2024).

2.2 Parameters

Each model is affected by a variety of factors. These factors include airframe, retirement plan, life expectancy, retirement age, rate of return, promotion schedule, marital status, hours flown for an airline per year, and BAH.

Airframe In reality, the idea of a pilot flying one airframe for his entire career is not perfectly accurate, as the pilot's aircraft selection depends mainly on his seniority. By analyzing three scenarios, we can get an understanding of the extremes of the situation. Though a pilot will never fly the most lucrative aircraft for his entire career, if the models find that even if he does, it is still worth it for him to stay in the military for at least twenty years, then there is a strong result in favor of staying in the military. Likewise, although a pilot will not fly the lowest paying aircraft for her entire career, if the models says that it is still worth it to get out in that scenario, we have a strong result to get out. In essence these bias the model in a certain direction to better understand the strength of the result. If a pilot has a better seniority number (i.e., he has been at the airline for a longer period of time), he has a preference in choosing both his hours and his aircraft. A junior first officer, for example, will likely need to fly on the weekends and holidays in smaller, less lucrative, aircraft since he has the last pick. A more senior pilot, by comparison, will likely be able to fly wide-body aircraft during regular working hours (Mattock et al. 2016). When a first officer promotes to captain, he once again loses seniority and will have to take the aircraft and hours that he can get since he is junior in that rank (Mattock et al. 2016). So, to say that a pilot will either fly wide-body aircraft or not for the entirety of his career is not accurate on an individual level, but analyzing the differences in income is worthwhile.

Retirement Plan There are two types of retirement plans in the military right now. The first known as High-36, in which the service member collects 2.5% times the years of service times the average of the highest paying three years. The second plan is the Blended Retirement System (BRS), in which the service member has the same pension pay but with a 2% multiplier instead of a 2.5% multiplier, but the service member also receives additional payment into his Thrift Savings Plan (TSP), a government retirement plan much like a 401k (US Department of Defense 2024). This analysis does not account for retirement account benefits, so it will always appear that the High-36 is better than the BRS, which is not always the case.

Life Expectancy Individuals living until 90 will collect far more in pension payments than those living until 75. Thus, lifetime earnings can be affected by this parameter. Though the individual does not know this number, he may want to consider it when making a career decision. For the purposes of this analysis, pilots always live until at least 65 years old, the age at which they retire.

Retirement Age The model sets the retirement age to 65 because that is the FAA-mandated retirement age (Hodges 2015). An individual can find employment in non-flying positions after this age, but 65 is a reasonable retirement age. To avoid going into the findings and salaries of

non-aviation fields, the final year a pilot works will be when he is 65.

Annual Rate of Returns The annual rate of returns represents the return for any given year. Though the market does not yield constant rates of return, this paper uses constant rates of return to show how they may affect total savings at the time of retirement or death without biasing the model by weighing specific periods of time more than others.

Promotion Schedule The promotion schedule indicates the highest rank an officer achieves (RAND Corporation 1980a). An aggressive promotion schedule is one in which the individual promotes as high as O-6, while typical is someone who promotes to O-5, and slow is someone who promotes as high as O-4. This analysis assumes that all pilots promote to O-4 at a minimum. The highest rank an individual reaches also determines how many years of service he is allowed to complete, according to the below table (RAND Corporation 1980b). Officers may not always be allowed to stay in until the maximum amount of time under selective continuation, but that operates on an individual basis, so this analysis assumes that they are allowed to stay in until the maximum years of selective continuation. Individuals cannot know for sure which rank will be the highest they can attain, so this analysis is here to show them the situation if they make it to O-4, O-5, or O-6 and what sort of difference it would make, rather than to prescribe a specific solution.

Marital Status A pilot's marital status affects how much BAH a pilot receives and taxes owed. This analysis looks at income after taxes, so marital status is significant.

Airline Annual Flying Hours Airline pilots are paid hourly, so their annual income is heavily affected by the number of hours flown in a year. United Airlines guarantees pilots 70 hours per month, but the FAA allows pilots to fly up to 1,000 hours yearly. Thus, the hours flown per year can vary from 840 to 1,000 (§14 CFR 121.841 1996).

BAH The parameter for basic allowance for housing pertains to the amount paid to a service member each month tax-free for housing. This amount varies with the "the costs of adequate housing for civilians with comparable income levels [to military Service members] in the same area," so the experimentation used three different locations: one was high, one was in the middle, and one was low (Defense Travel Management Office 2022) . Note that these do not necessarily represent flying bases, or the bases where pilots might be stationed, but could easily be switched out to show that. Instead, they represent the spread of BAH payments. Specifically,

the high used San Francisco, the middle used Patrick Space Force Base, and the lowest BAH used Altus Air Force Base. These rates can be seen in Appendix C.

2.3 Assumptions

Some additional assumptions the models use are that the pilot will be able to find a job flying for a major civilian airline immediately upon separating from the Air Force regardless of time in service, and he will never get fired or furloughed from the airline he flies for. Additionally, a pilot does not switch airlines once he starts flying, as that would reset his pay scale. Pilots promote from first officer to captain after seven years. This may vary with the airline, individual, and state of the market, but is a reasonable assumption (Mattock et al. 2016). This analysis uses United Airlines because it is among the major airlines and has publicly available data, but the approach is general enough to use other airlines' pay charts. This analysis also ignores the AvB and other incentive pays designed to retain pilots, because it aims to discover the proper size for these to effectively compete with major civilian airlines. Further, the USAF adjusts annual pay based on the consumer price index (CPI), and airlines adjust annual pay based on union contracts. Over the last 20 years, these have changed at similar rates, so this analysis assumes that they will continue to change at the same rate, with inflation.

2.4 Models

2.4.1 Myopic Approach

This methodology is straightforward. A pilot can see how his annual compensation changes based on the year he chooses to separate from the military. It is a myopic model because it looks forward at only one year of compensation and does not look at the net effect of a separation decision in the long term. Though a pilot would want to know more than just the following year's earnings, it is a simple first look at how separating from the Air Force would immediately affect him, and an important approach. For example, if a pilot thought he could not live on less than $100,000, and he saw that he would be making less than that, he would not need to do further analysis and could make his decision from there. In the opposite direction, if a pilot was content earning anything over $50,000 each year, and indifferent to additional earnings, he could decide that it is worth it to get out if it seems like a job that he would enjoy more than flying for the military. The myopic model computes the annual earnings by year of separation, y. In this approach, one can see what a pilot's pay would be the following year if a pilot got out or stayed in by changing the variable y.

Let $m(n)$ be the dollars earned in the n^{th} year of service in the US military, $c(n)$ be the dollars earned from an airline in the n^{th} year working for that airline, and $p(y)$ be the annual pension earnings from separating from the military after y years of service. Then $p(y)$ is computed as

$$p(y) = \begin{cases} z \cdot y \cdot h(y), & y \geq 20 \\ 0, & \text{otherwise} \end{cases} \tag{2.1}$$

where z is either 2% for the BRS or 2.5% for the High-36, and $h(y)$, the highest average three years of pay, is calculated as

$$h(y) = \frac{m(y-2) + m(y-1) + m(y)}{3}. \tag{2.2}$$

Then the annual amount earned in year n after commissioning when the pilot separates from the Air Force after y years is given by

$$g(n,y) = \begin{cases} t(m(n)) + BAH_n + BAS, \\ \quad \text{Stay in the Air Force} \\ t(c(n-y) + p(y)), \\ \quad \text{Separate} \end{cases} \tag{2.3}$$

where $t(D)$ is the income after taxes on D earnings, computed from IRS federal tax brackets, BAH_n represents the BAH earned in the n^{th} year of service, and BAS is the basic allowance for subsistence, which is a constant.

2.4.2 Lifetime Earnings

In the lifetime earnings approach, a pilot can look at how much money he would make throughout his career. This is a very reasonable thing for pilots to look at, as it indicates an entire career's worth of earnings rather than just the next year. Note that the year of separation, y, must be greater than or equal to 12 since a pilot's ADSC keeps him in until at least that point. Given $m(n)$, $c(n)$, and $p(n)$, then lifetime earnings, $l(y)$, is given by

$$l(y) = \left[\sum_{n=1}^{y} (t(m(n)) + BAH_n + BAS)\right] + \left[\sum_{n=1}^{65-y-a} t\left(c(n) + p(y)\right)\right] + \left[(LE - 65) \cdot t\left(p(y)\right)\right], \tag{2.4}$$

where a is the age of the officer at the time of commissioning, n is the year of service, and $LE \geq 65$ is his life expectancy.

2.4.3 Savings at Retirement

The final model looks at the individual's savings at the time of retirement. This model is likely of the most interest to pilots deciding whether to stay in the Air Force, as it is a standard metric. It is easy to think about the specific number that a person wants to have in a retirement account by the time he retires. A pilot could look at the result from this model to see what separation year yields the maximum lifetime savings, and also see the trade off, and then make their decision. For example, if the individual aims to have $4 million at the time of retirement, and sees that regardless of when he gets out, he can attain that level of wealth, he can make his decision purely based on which career path he thinks he might enjoy more. If the individual is more sensitive to changes in wealth even at high levels, his decision might be more driven by an aim to maximize total savings at retirement. The savings at the time of retirement when an individual separates from the military at year y, $s(y)$, is given by

$$\begin{aligned} s(y) = &\left[\sum_{n=1}^{y} [t(m(n)) + BAH_n + BAS] \cdot k \cdot (1+i)^{65-a-n}\right] \\ &+ \left[\sum_{n=1}^{65-y-a} t\left(c(n)+p(y)\right) \cdot k \cdot (1+i)^{65-n-a}\right] \\ &+ t(p(y)) \cdot \left(\frac{(1+i)^n - 1)}{(i(1+i)^{LE-65}}\right), \end{aligned} \tag{2.5}$$

where k denotes the individual's savings rate, and i indicates the annual rate of return. Note that a savings rate of k equal to 1 would indicate the maximum amount of money an individual could earn in a lifetime from military compensation, airline compensation, pension pay, and interest. The first term in Equation 2.5 represents the total money earned in the military, the second designates the total money earned after separating from the military but before retiring, and the third term signifies the net present value (NPV) of the pension at the time of retirement at age 65.

CHAPTER

3

AIR FORCE CAREER VALUE

3.1 Scenarios

In analyzing the three models introduced in Chapter 2, this paper examines three scenarios a pilot might face: 1) a scenario that would skew a pilot's best interest to get out, 2) a neutral or typical scenario, and 3) a scenario that makes it so it is in the pilot's best interest to stay in. The analysis varied the values of the parameters such that they would cause changes in the outcomes of the models to benefit one or the other.

Table 3.1: Parameters defining the three scenarios.

Scenario	Favors	Life Exp	Ret Plan	Highest Rank	Aircraft	BAH
S1	Airline	75	BRS	O-4	Wide Body	Low
S2	Neither	80	BRS	O-5	Narrow-Long	Mid
S3	Military	85	High-36	O-6	Narrow-Short	High

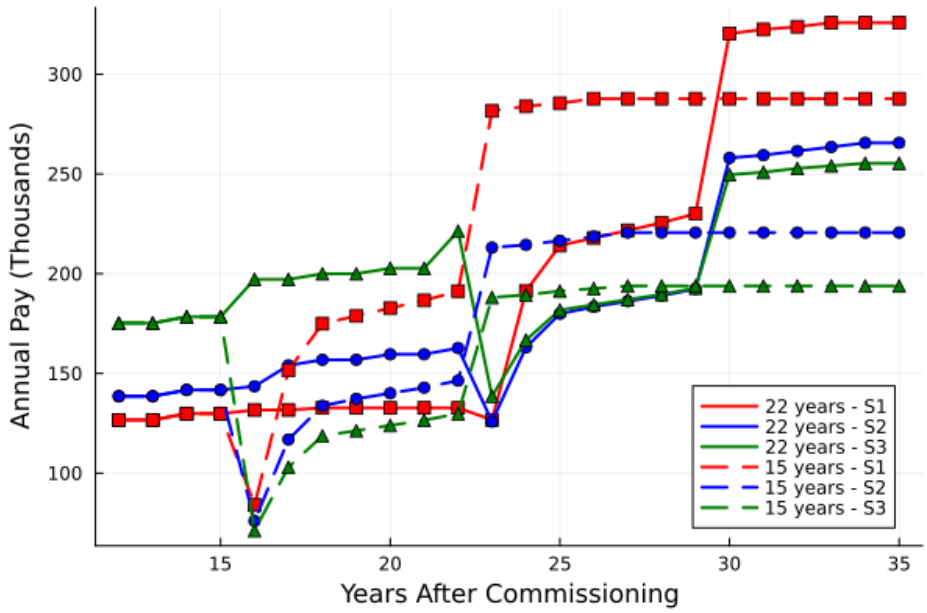

Figure 3.1: Annual Earnings Separating at 15 vs 22 years, with Scenarios Defined in Table 3.1

3.2 Model 1: The Myopic Approach

The effect of the decision to separate after 15 or 22 years is demonstrated in Figure 3.1, where 15 and 22 years are chosen arbitrarily to illustrate the effect of leaving before and after 20 years of military service. Under this formulation, one can observe that pilots experience a moderate decrease in earnings when switching from military aviation to the airlines. Further, the highest earnings come from the pilot who retired from the military and collected a pension. Additionally, pilots' earnings do not decrease as much leaving after at least 20 years of service, as they earn money from a pension, which compensates for the lack of earnings at the airline in the first year.

3.3 Model 2: Lifetime Earnings

Under the lifetime earnings model, the Air Force pilot in scenario one would maximize lifetime earnings by separating after his initial ADSC. However, if he chooses to stay for 15 years, he would be better off waiting until 20 years of service to maximize his lifetime earnings. The highest achievable lifetime earnings shown are from an individual who stays in the military as long as he is able to with selective continuation as an O-6, earning up to $11M throughout his lifetime. Note that the different scenarios have different lengths, associated with how long military officers are allowed to stay in the military. Once a pilot reaches the maximum amount

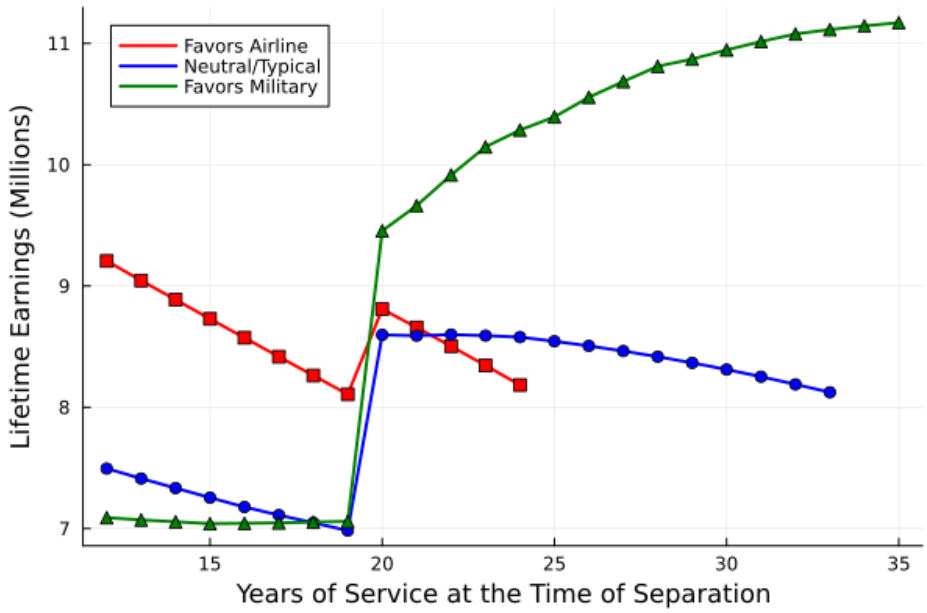

Figure 3.2: Lifetime Earnings by Year of Separation

of time allowed under selective continuation, he must separate from the USAF. Interestingly, lifetime earnings for scenario three are non-decreasing after 20 years, as the pension payout continues to grow from time in service. Lifetime earnings for scenarios one and two shown in Figure 3.2 are non-increasing before and after 20 years of service but increase at 20 years due to the pension they secure at the 20-year mark.

3.4 Model 3: Savings at Retirement

The final model's results show that all career paths are incentivized to stay in until at least 20 years of service, as seen in Figure 3.3. Suppose an individual knows before hitting 20 years that he does not want to stay in for that long. In that case, to maximize wealth the pilot should to leave immediately following the expiration of his ADSC under scenarios one and two. This is because savings at retirement decrease in years of service in both scenarios, with the exception of year 20, when there is a big jump from the pension. In scenario three, total savings increase throughout years of service, so a pilot would not be losing out financially by staying in the military longer than 12 years, but less than 20.

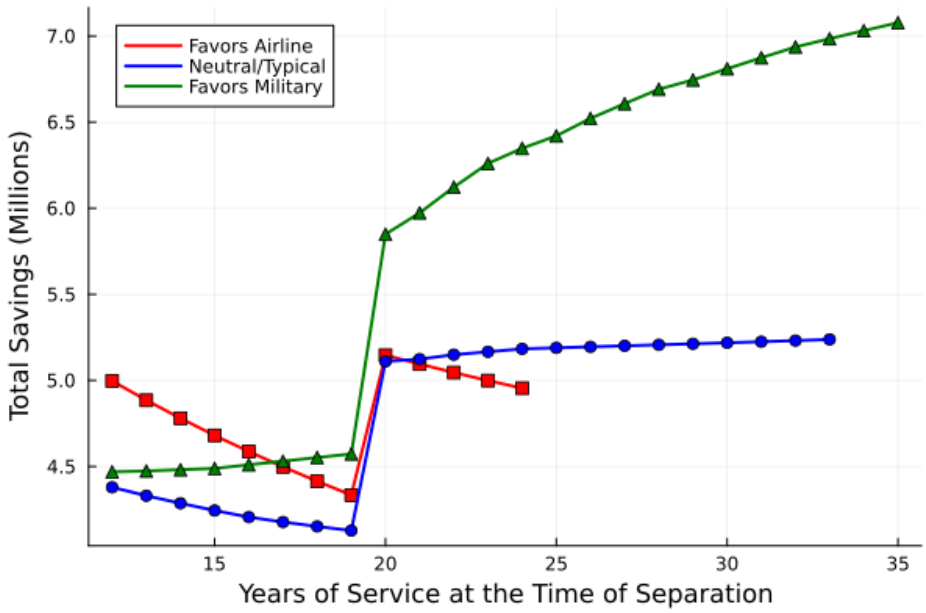

Figure 3.3: Retirement Savings by Separation Year

3.5 Evaluating the Impact of Individual Parameters

Note that the above scenarios are only three of a large set of possible scenarios pilots might find themselves in. To account for this, this paper explores the effects of individual parameters on annual earnings, lifetime earnings, and savings at retirement. By holding constant all but one parameter, it is possible to see which parameters are most important. For the all analysis of these parameters, unless otherwise indicated, default parameter values are set as in Table 3.2. The big takeaways from this analysis are that the highest rank a pilot can achieve, his or her savings rate, and the rate of return greatly affect his or her accumulation of wealth after 20 or more years of service, and play an important role in the decision to stay in the military or leave after that point as seen in Figure D.7, Figure D.32 and Figure D.31. Regardless of rank achieved, however, pilots are financially incentivized to stay in the military until at least 20 years of service. In none of the scenarios analyzed varying just one model from a more typical scenario did the models indicate that is financially beneficial for a pilot to separate from the military prior to 20 years of service. Even if an Air Force pilot were not to receive BAH, he or she would benefit economically by staying in the military for at least 20 years before separating, as shown in Figure D.27.

Table 3.2: Parameter Values When Not Being Varied

Parameter	Value
Life Expectancy	80 years
Retirement Plan	High-36
Highest Rank	O-5
Marital Status	Married
Hours	900
Aircraft	767-300
BAH Location	Patrick SFB, FL
Annual Return	5%
Savings Rate	20%

3.6 Summary

In sum, it is better to get out at 20 years or later in five of the six model-situation pairings and better to get out at twelve years of service only for the civilian-favored situation from a lifetime earnings perspective. See Table 3.3 for a comparison of the results of the lifetime earnings and savings at retirement models and situations. To use this analysis, an individual should examine their situation and understand all three models' implications. First, an individual needs to look at the annual earnings so that they can see how their lifestyle will immediately shift, and then look at the total lifetime earnings and savings at retirement. Of course, individuals must weigh their particular needs and preferences alongside their associated costs and potential additional earnings. Specific individuals may not get additional benefit or utility from having three million extra dollars in savings at the time of retirement, and they are content to have 3.5 million at the time of retirement instead. Other individuals, however, may benefit from this much more.

In Table 3.3, there is only instance where it optimal to leave prior to 20 years, and that is at year 12 when maximizing lifetime earnings in a situation that financially favors the airlines. These findings are supported by alternative dynamic programming models found in Appendix E. For the USAF to make staying in until 20 years financially equal to separating after 8 for this individual, it would have to pay them 4.6% more over the next 8 years. This is $130,000 over 8 years, or $16,250 in additional annual payment. This amount is far less than the current aviator bonus, and very near the total annual flight pay, indicating that even in situations which most favor leaving the airlines, the USAF is still financially competitive.

Table 3.3: Financial Outcomes for Associated USAF Career Lengths, where all Dollar Amounts are in Millions

Favors	Sep at 12 Yrs	Sep at 20 Yrs	Sep after Optimal Yrs	Optimal Yrs of Service	% Diff Between 12 and 20	% Diff between 20 and Optimal
Airline Savings	$5.00	$5.15	$5.15	20	3.0%	0.0%
Neutral Savings	$4.38	$5.11	$5.24	33	16.7%	2.5%
Military Savings	$4.47	$5.85	$7.08	35	30.9%	21.0%
Airline Earnings	$9.21	$8.81	$9.21	12	-4.3%	4.5%
Neutral Earnings	$7.49	$8.60	$8.60	20	14.8%	0.0%
Military Earnings	$7.09	$9.45	$11.12	35	33.3%	17.7%

CHAPTER

4

CONCLUSION AND FUTURE WORK

4.1 Conclusion

A pilot generally benefits financially from staying in the military at least until 20 years of service. After this, depending on the situation, his lifetime earnings may decrease if he elects to continue in military service, but his savings at retirement generally increase. In particular, pilots who have a good chance of making O-6 nearly always stand to earn more over a lifetime by staying in than by getting out, and benefit from staying in when using the savings at retirement metric. Pilots who promote only as high as O-4 may be incentivized in either direction depending on other factors in their career, but the difference between getting out and staying in prior to 20 years of service is not large. The biggest increase in lifetime earnings and savings at retirement comes after completing the 20^{th} year of service, and afterwards the increases diminish. This assumes that a pilot will be capable of getting hired by an airline at any point after separating from the military, regardless of age.

From analysis, it is clear that USAF pilots are compensated very well. In fact, they are generally compensated better than airline pilots when accounting for the military pension. One could conclude that the Air Force does not need to change compensation, and could even eliminate the AvB and flight pay, but this would be a misjudgement, and only serve to exacerbate the retention problem, as decreases in AvB result in diminished retention (Mattock

et al. 2019). Not only would pilots continue to think that they are being underpaid, but they would think it is worse than it was before, and they may feel resentment for not having it available anymore. The problems that the Air Force needs to focus on are twofold: 1) USAF pilots perceive that they will make more money when they leave the military both immediately and over the course of their careers, and the Air Force reinforces this by saying things like "[w]e cannot compete on financial terms alone," when, in fact, it can and does compete on financial terms (Switzer 2020). The USAF needs to advertise that its pay is competitive so that pilots do not operate under the unfounded assumption that they are making a financial sacrifice to continue in their service. 2) The USAF needs to continue to find ways to improve quality of life benefits for USAF pilots. Regardless of the financial package, if pilots do not enjoy flying for the USAF, they will get out sooner. Airline pilots work fewer days, do not deploy, and have greater flexibility, so it is important that the USAF continues to compensate its pilots well and work to improve QOL to retain them.

If a pilot is incentivized to stay in the military financially and by quality of life, it is far more likely that he will. It would be unreasonable to expect that a pilot would stay in a position he did not enjoy where he made less money. The Air Force needs to sell the true narrative that pilots can have very lucrative military careers, and push to improve operations such that the career can be more competitive with airlines by emphasizing the mission, ethos, and service. Additionally, although congress needs to authorize the AvB annually, the Air Force has a set amount that it knows it will be able to pay out as a minimum, but does not communicate this clearly to its pilots until the time comes to offer it. Instead, the AvB opens up once per year, and pilots are rushed into a decision. If pilots could count on the AvB or a wage differential, that would be beneficial for minimizing pay uncertainty. It is important to change the narrative and culture around pilot pay.

4.2 Future Work

In the future, it would be beneficial for someone to analyze an effective way to communicate this information to pilot communities to boost retention. Switzer (2020) recommends council from squadron commanders before pilots make a decision to stay in or separate, but the specific discussion surrounding the separation decision is important. If pilots think they are sacrificing economic opportunity, there will always be some motivation to leave, regardless of other qualitative changes made. Implementing the program to make more charts for specific career pathways would also be beneficial, as would a stochastic dynamic programming approach to the problem, which would yield a policy for each year-rank pairing. It would also be useful for this problem to be looked at in times when airline demand is low, and pilots would be more

likely to need to get a job at a regional airline prior to getting hired at a major airline. It would also be valuable to look at the effect of the aviator bonus and flight pay on retention incentives, rather than only at retention outcomes. Additional factors to include or test are non-monetary benefits, a utility model rather than economic only model, and comparing changes in pay with inflation or union negotiations at airlines.

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APPENDICES

APPENDIX

A

ACRONYMS

A summary of all acronyms is documented in Table A.1.

Table A.1: A summary of acronyms used in alphabetical order.

Abbreviation	Acronym
ADSC	Active Duty Service Commitment
AvB	Aviator Bonus
BAH	Basic Allowance for Housing
BRS	Blended Retirement System
BAS	Basic Allowance for Subsistence
UPT	Undergraduate Pilot Training
USAF	United States Air Force

APPENDIX

B

VARIABLES

A summary of all variables is documented in Table B.1.

Table B.1: A summary of variables and their meanings in alphabetical order.

Variable	Meaning
a	commissioning age
$c(x)$	earnings from an airline in the x^{th} year working for that airline
D	dollar amount
$g(x,y)$	earnings in year x when separating at year y
$h(y)$	average of highest three paying years of military service
k	savings rate
$l(y)$	lifetime earnings for a pilot separating after y years of military service
LE	life expectancy
$m(x)$	earnings in the military in x^{th} year of service
$p(y)$	annual pension earnings after y years of service
r	annual return
$t(D)$	earnings after taxes on $\$D$
x	year of service
y	years of service at separation

z	pension multiplier

APPENDIX

C

INPUT DATA

Table C.1: BAH by Marital Status, Rank and Location.

Location	Rank	Married (M)	Single (S)
San Francisco, CA	O-1	4512	4017
	O-2	4908	4380
	O-3	5004	4743
	O-4	5934	4938
	O-5	6606	4956
	O-6	6663	4998
Patrick SFB, FL	O-1	2552	2010
	O-2	2664	2298
	O-3	2703	2550
	O-4	2877	2667
	O-5	3012	2679
	O-6	3036	2682
Altus AFB, OK	O-1	1143	1035
	O-2	1403	1128
	O-3	1659	1299
	O-4	1887	1497
	O-5	2049	1554
	O-6	2064	1641

Table C.2: United Airlines Captain Pay by Aircraft and Year (in Thousands of Dollars)

Aircraft	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12
757-200	260	262	264	266	268	270	273	275	277	279	281	283
777	323	325	328	331	333	336	339	341	344	347	349	352
A319	249	251	253	255	257	259	261	263	265	268	270	272
A320	260	262	264	266	268	270	273	275	277	279	281	283
737-700	249	251	253	255	257	259	261	263	265	268	270	272
737-800	260	262	264	266	268	270	273	275	277	279	281	283
737-900	260	262	264	266	268	270	273	275	277	279	281	283
757-300	267	269	271	273	276	278	280	282	284	287	290	293
767-200	267	269	271	273	276	278	280	282	284	287	290	293
767-300	267	269	271	273	276	278	280	282	284	287	290	293
767-400	325	328	331	333	336	339	341	344	347	349	352	352
787	323	325	328	331	333	336	339	341	344	347	349	352

Table C.3: United Airlines First Officer Pay by Aircraft and Year (in Thousands of Dollars)

Aircraft	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	**Year 11**	**Year 12**
737-500	91	134	157	161	165	169	174	178	180	182	184	186
737-700	91	134	157	161	165	169	174	178	180	182	184	186
737-800	91	140	164	168	172	176	181	185	187	190	192	193
737-900	91	140	164	168	172	176	181	185	187	190	192	193
757-200	91	140	164	168	172	176	181	185	187	190	192	193
757-300	91	144	168	173	177	181	186	191	193	196	198	200
767-200	91	144	168	173	177	181	186	191	193	196	198	200
767-300	91	144	168	173	177	181	186	191	193	196	198	200
767-400	91	174	204	209	214	219	225	230	233	236	238	240
777	91	174	204	209	214	219	225	230	233	236	238	240
A319	91	134	157	161	165	169	174	178	180	182	184	186
A320	91	140	164	168	172	176	181	185	187	190	192	193
787	91	174	204	209	214	219	225	230	233	236	238	240

Table C.4: The probability that an individual reaches at least a certain rank, given they made O-4

Rank	Probability
O-4	1
O-5	0.70
O-6	0.35

Table C.5: Probability of promoting to each rank, given the previous rank was reached

Rank	Probability
O-4	0.9
O-5	0.7
O-6	0.5

Table C.6: The probability an officer will reach a certain rank as his highest rank if he stays in and reached O-4 by 12 years of service

Rank	Probability
O-4	0.30
O-5	0.35
O-6	0.35

Table C.7: Years of Service Allowed in Selective Continuation

Rank	Years of Service Allowed
O-4	24
O-5	33
O-6	35

APPENDIX

D

SUPPLEMENTAL RESULTS

Table D.1: Annual Earnings for Airline, Neutral and Military Favored Situations (in Thousands of Dollars). Note: The "Year" column refers to the years of service at the time of separation.

Year	22 years - Favors Airline	15 years - Favors Airline	22 years - Neutral/Typical	15 years - Neutral/Typical	22 years - Favors Military	15 years - Favors Military
12	123.17	123.17	135.05	135.05	171.74	171.74
13	123.17	123.17	135.05	135.05	171.74	171.74
14	126.35	126.35	138.23	138.23	174.91	174.91
15	126.35	126.35	138.23	138.23	174.91	174.91
16	128.17	84.02	140.05	76.02	193.70	71.21
17	128.17	151.53	150.57	116.90	193.70	103.00
18	129.22	174.93	153.35	133.75	196.48	118.68
19	129.22	178.83	153.35	137.26	196.48	121.30
20	129.22	182.73	156.10	140.06	199.23	123.92
21	129.22	186.63	156.10	142.87	199.23	126.54
22	129.22	191.21	159.22	146.38	217.86	129.81
23	126.69	281.65	125.84	213.10	138.55	188.11
24	191.33	283.93	163.04	214.46	166.72	189.38
25	214.13	285.45	179.89	216.52	181.79	191.30
26	217.93	287.73	183.40	218.57	184.41	192.58
27	221.73	287.73	186.21	220.62	187.03	193.85
28	225.53	287.73	188.97	220.62	189.60	193.85
29	230.09	287.73	192.39	220.62	192.79	193.85
30	320.39	287.73	258.06	220.62	249.61	193.85
31	322.43	287.73	259.43	220.62	250.88	193.85
32	323.79	287.73	261.48	220.62	252.80	193.85
33	325.83	287.73	263.53	220.62	254.07	193.85

Table D.2: Lifetime Earnings by Year of Separation for Airline, Neutral, and Military Favored Situations (in Thousands of Dollars)

Year of Separation	Favors Airline	Neutral/Typical	Favors Military
12	9.21	7.49	7.09
13	9.04	7.41	7.07
14	8.89	7.33	7.06
15	8.73	7.25	7.04
16	8.57	7.18	7.04
17	8.42	7.11	7.05
18	8.26	7.05	7.05
19	8.11	6.98	7.06
20	8.81	8.60	9.45
21	8.66	8.59	9.66
22	8.50	8.60	9.92
23	8.34	8.59	10.15
24	8.18	8.58	10.29
25	N/A	8.54	10.39
26	N/A	8.51	10.56
27	N/A	8.46	10.69
28	N/A	8.42	10.81
29	N/A	8.37	10.87
30	N/A	8.31	10.95
31	N/A	8.25	11.02
32	N/A	8.19	11.08
33	N/A	8.12	11.11
34	N/A	N/A	11.11
35	N/A	N/A	11.12

D.1 Evaluating the Effects of Individual Parameters

Life Expectancy One can see that as life expectancy increases, the benefit of a military pension increases, and shows itself in the lifetime earnings. The annual earnings analysis is unchanged, since life expectency is always assumed to be greater than 65, but lifetime earning increase in y as LE increases.

Retirement Plan As mentioned above, the retirement plan is simplified in this analysis, as it does not include the tax-advantaged accounts or employer matches that pilots would realistically invest in. Instead, the High-36 plan and the BRS are compared on the proportion of income paid out annually in a military pension. From this analysis, it can be easily seen in Figure D.4 that the High-36 retirement system incentivizes pilots to stay in for at least 20 years,

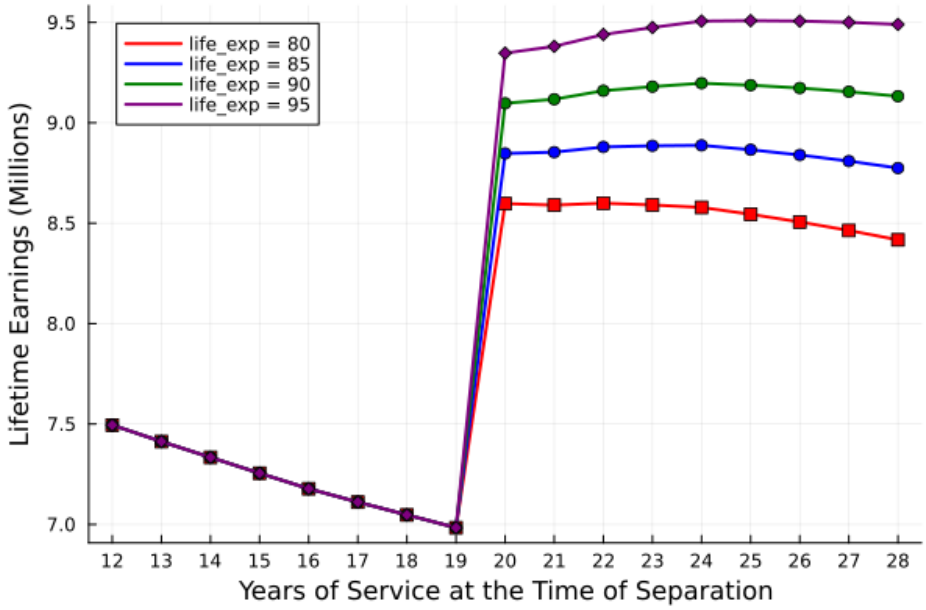

Figure D.1: The Impact of Life Expectancy on Lifetime Earnings and Separation Incentives

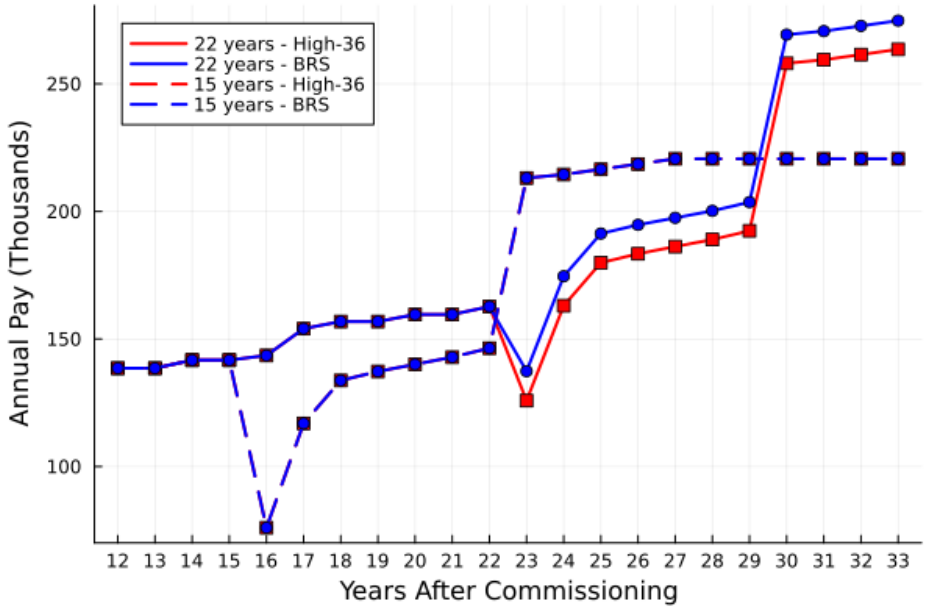

Figure D.2: The Impact of Retirement Plan on Annual Earnings

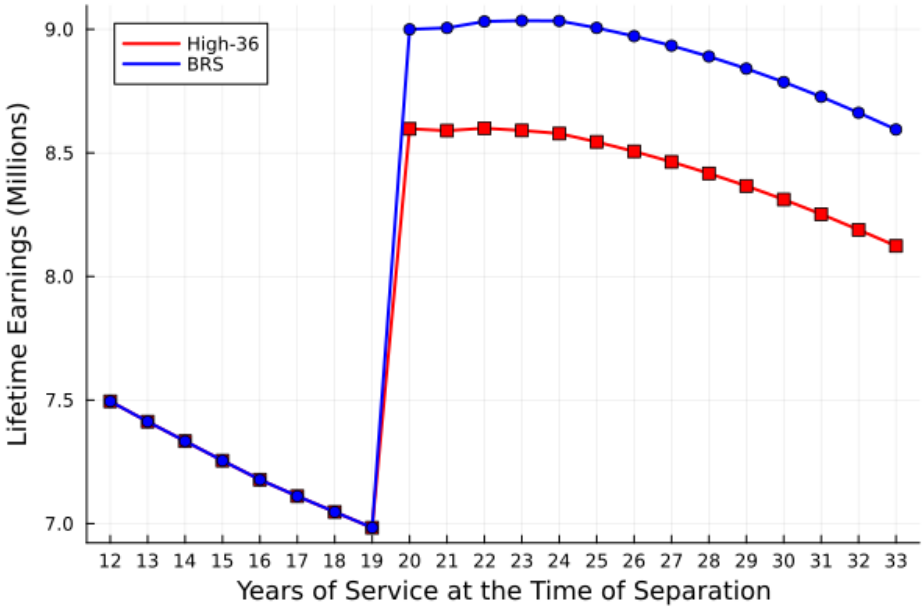

Figure D.3: The Impact of Retirement Plan on Lifetime Earnings

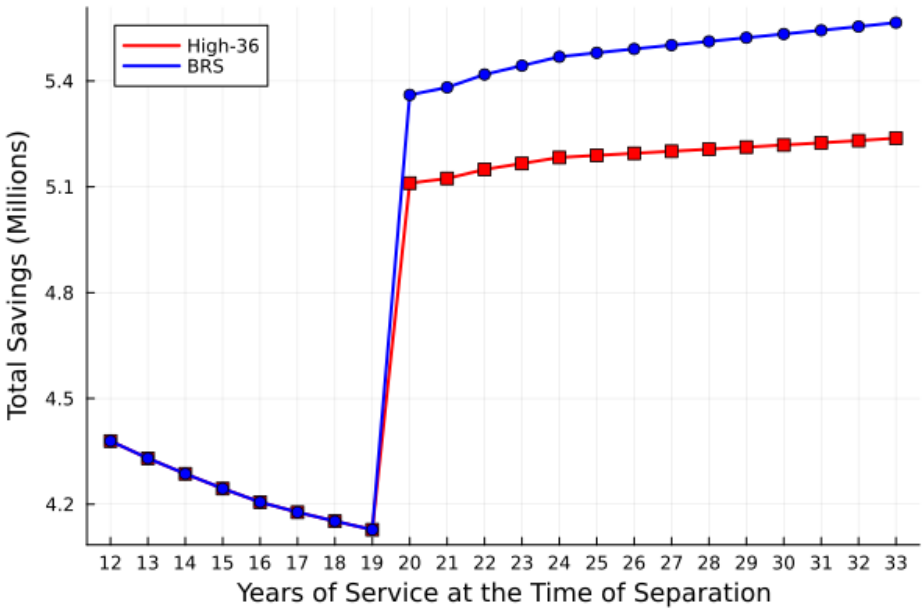

Figure D.4: The Impact of Retirement Plan on Savings at Retirement

Table D.3: Savings at Retirement by Year of Separation for Airline, Neutral, and Military Favored Situations (in Millions of Dollars)

Year	Favors Airline	Neutral/Typical	Favors Military
12	5.00	4.38	4.47
13	4.88	4.33	4.47
14	4.78	4.29	4.48
15	4.68	4.24	4.49
16	4.59	4.21	4.51
17	4.50	4.18	4.53
18	4.41	4.15	4.55
19	4.33	4.13	4.57
20	5.15	5.11	5.85
21	5.09	5.12	5.97
22	5.05	5.15	6.12
23	5.00	5.17	6.26
24	4.95	5.18	6.35
25	N/A	5.19	6.42
26	N/A	5.20	6.52
27	N/A	5.20	6.61
28	N/A	5.21	6.69
29	N/A	5.21	6.75
30	N/A	5.22	6.81
31	N/A	5.22	6.87
32	N/A	5.23	6.94
33	N/A	5.24	6.98
34	N/A	N/A	7.03
35	N/A	N/A	7.08

as pilots under this retirement plan earn an additional 20% more in pension annually. Prior to 20 years, this makes no difference in separation decisions, as pilots separating before then do not earn a pension. Note that as life expectancy increases, lifetime earnings will be more affected by retirement plan.

Highest Rank The highest rank an officer will promote to has the potential to make a big impact on retention decisions. Varying only promotion results in two different outcomes. An individual who would promote to O-6 is financially incentivized to stay in the Air Force until 28 years by the lifetime earnings, while individuals promoting only to O-4 or O-5 are incentivized to stay in for only 20 years under the same model. Note that these specific year-earnings pairs vary as other parameters change as well. It is unsurprising that pilots who promote to higher

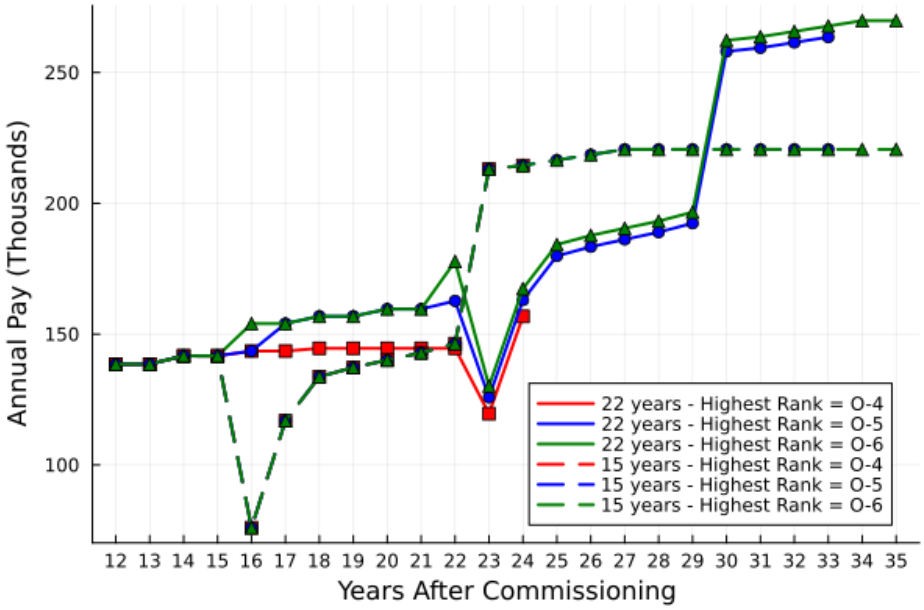

Figure D.5: The Impact of Promotions Annual Earnings

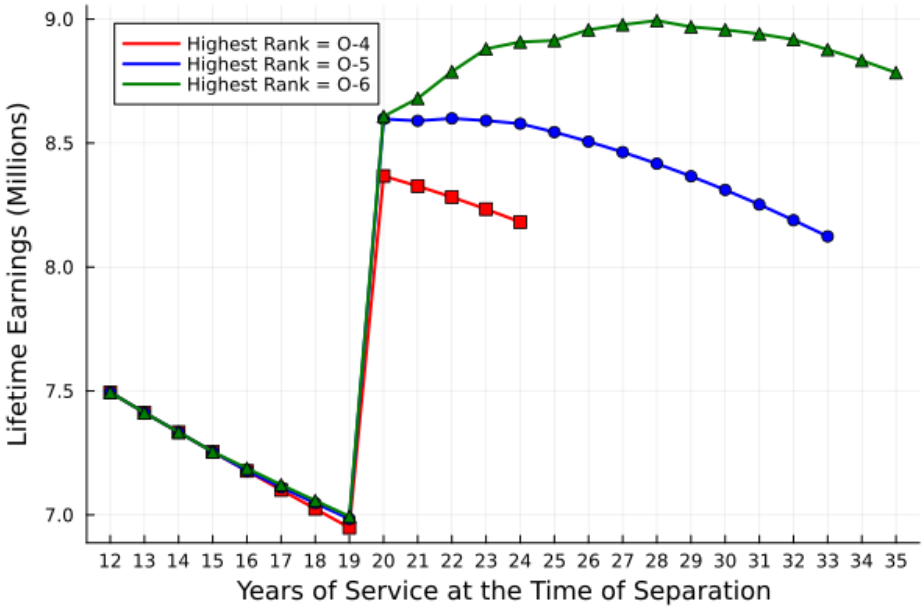

Figure D.6: The Impact of Promotions on Lifetime Earnings

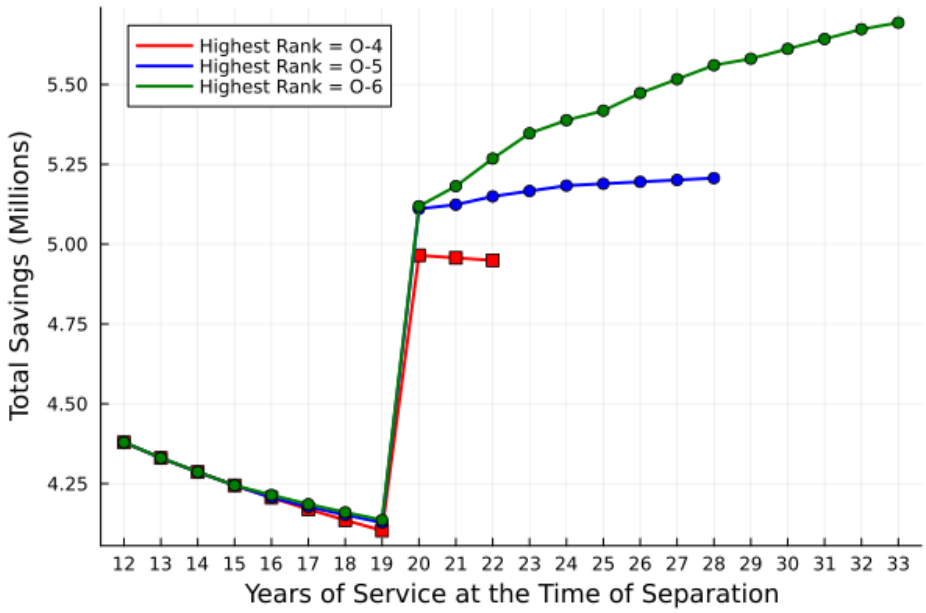

Figure D.7: The Impact of Promotions on Savings at Retirement

ranks stand to earn more money over the course of their lifetimes. The part which is surprising is that pilots can be financially motivated to stay in the military beyond 20 years of service. Traditional wisdom says that pilots staying in the military after 20 years are "working for half the pay," as they could separate and continue to earn a portion of their base pay as a pension. Note that selective continuation allows officers to stay in the military for a certain amount of time, depending on rank. Officers who fail to promote must apply for selective continuation, which determines how much longer they are allowed to stay in. Officers who reach this limit are forced to separate from the military. These can be seen in Table C.7.

Aircraft The aircraft that a pilot flies for an airline can affect his earnings greatly. Before viewing the results, note that this analysis of the effect of aircraft on earnings is an artificial analysis, as noted earlier. In reality, pilots can choose the aircraft that they fly based on their seniority number. Those who have been flying for the airline longer in their current rank typically fly the more lucrative aircraft. Junior members are more likely to fly the lower-paying aircraft. When viewing this graph, it is helpful to think about how the right third of Figure D.10 is likely accurate for "lucrative," the middle third is accurate for "typical," and the left third is accurate for "low-paying," as junior pilots fly "low-paying," middle-seniority would fly "typical," and senior pilots would fly "lucrative" aircraft. One can see that pilots flying wide-body aircraft have a far higher annual earnings maximum than those flying narrow-body aircraft. All three are incentivized from a lifetime earnings perspective to exit the military after

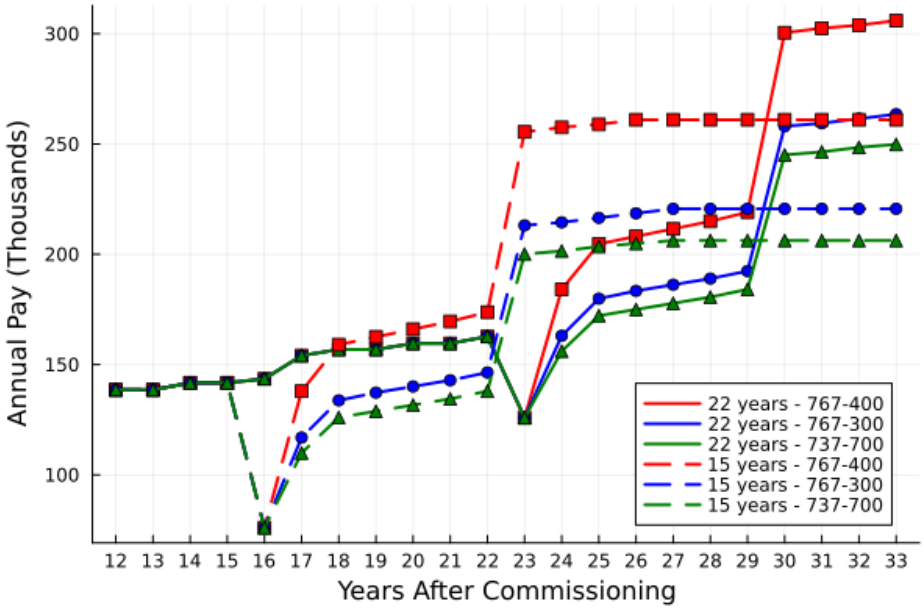

Figure D.8: The Impact of Aircraft on Annual Earnings

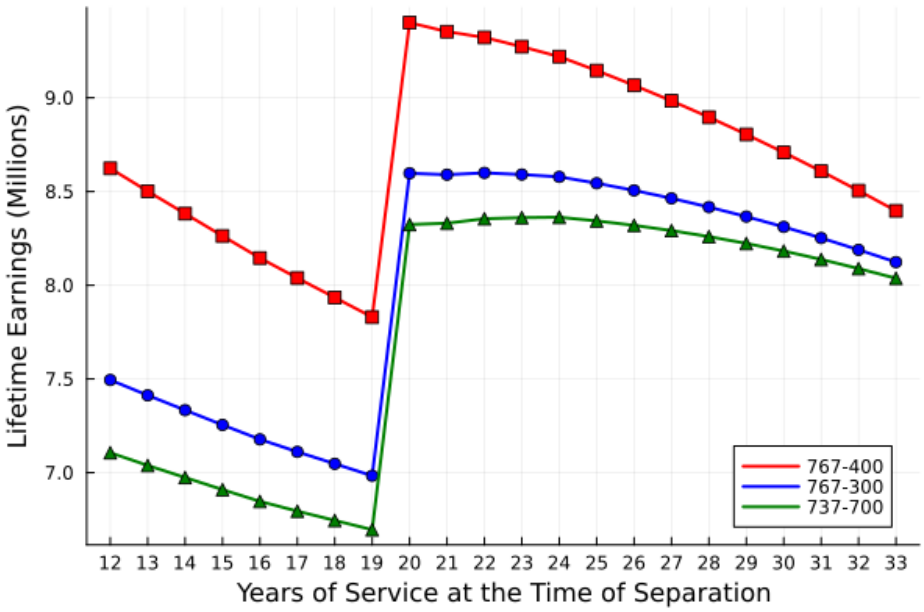

Figure D.9: The Impact of Aircraft on Lifetime Earnings

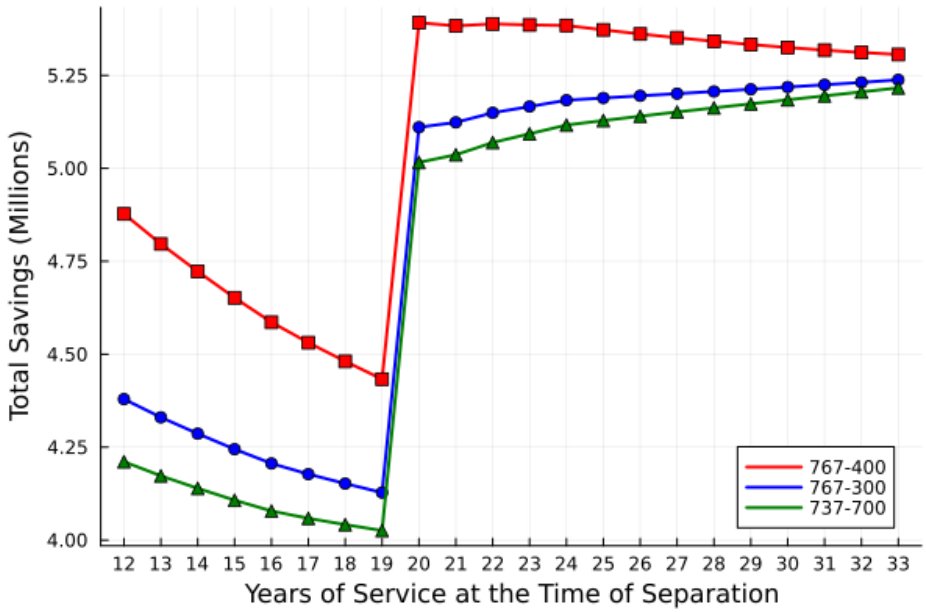

Figure D.10: The Impact of Aircraft on Savings at Retirement

20 years of service. Under the savings model, the pilots flying the "typical" and "low-paying" aircraft are incentivized to stay in the military for as long as they can, while pilots who would fly lucrative airline jets are economically motivated to separate to maximize wealth. Note that even if civilian pilots did fly only one type of aircraft, they still would be unlikely to know for certain which it would be.

Hours Similar to the caveat above, a pilot has greater say in choosing his or her hours as they gain seniority. Likely they would be able to get near 1000 annual hours even at a lower seniority, but their timing would be considered not ideal, such as weekends, holidays, or poor times of day and night. Again, these graphs are assuming that all else is held equal. One can see from Figure D.13 that a pilot flying more hours has more incentive to leave the Air Force after 20 years under both the lifetime earnings and the savings models. In the myopic model, one can see that pilots flying more hours take less of a pay cut after separating from the Air Force.

BAH As one would expect, pilots earning high BAH are less incentivized to separate from the Air Force, as they take a greater pay cut as seen in Figure D.21. This is especially true for married pilots, as they earn an even higher BAH than single pilots in the same area. Earnings and savings are unsurprisingly far higher for pilots with a high BAH, as indicated in Figures D.27 and D.12, and a high BAH can be a sufficient motivator for pilots to continue service rather than separate. Note that BAH is a function of the cost of housing in an area, so if it is higher,

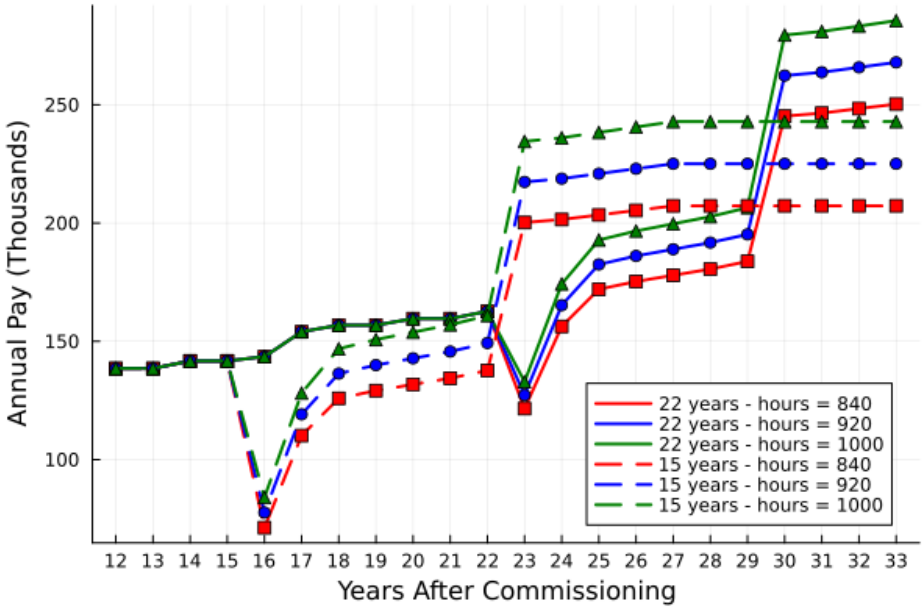

Figure D.11: The Impact of Flying Hours on Annual Earnings

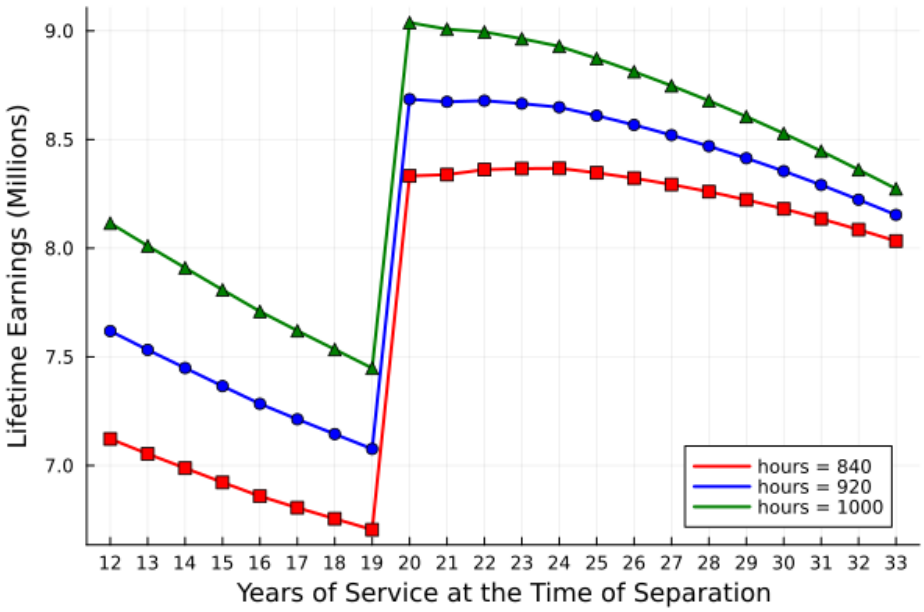

Figure D.12: The Impact Flying Hours on Lifetime Earnings

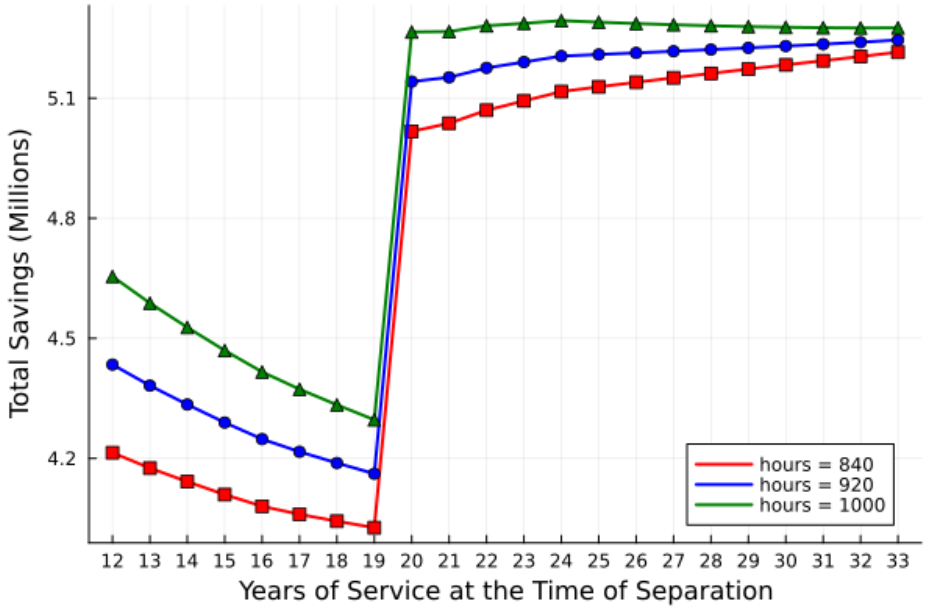

Figure D.13: The Impact of Aircraft on Savings at Retirement

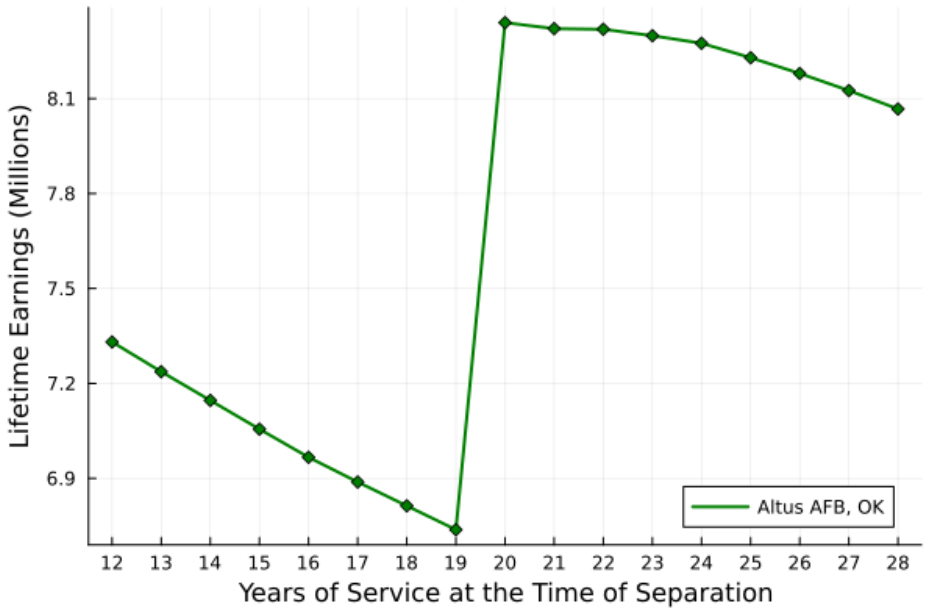

Figure D.14: The Impact of BAH on Lifetime Earnings: Altus AFB, OK

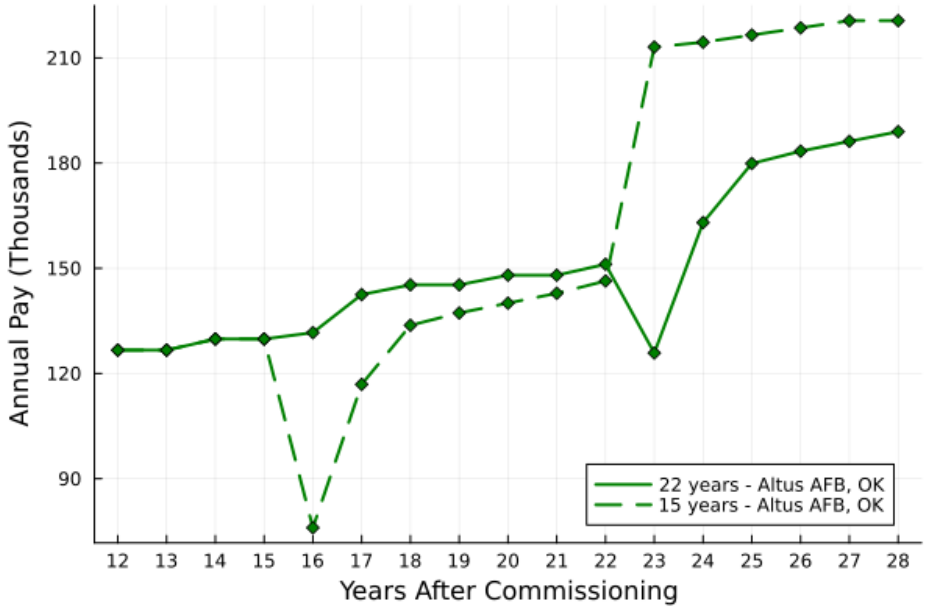

Figure D.15: The Impact of BAH on Annual Earnings: Altus AFB, OK

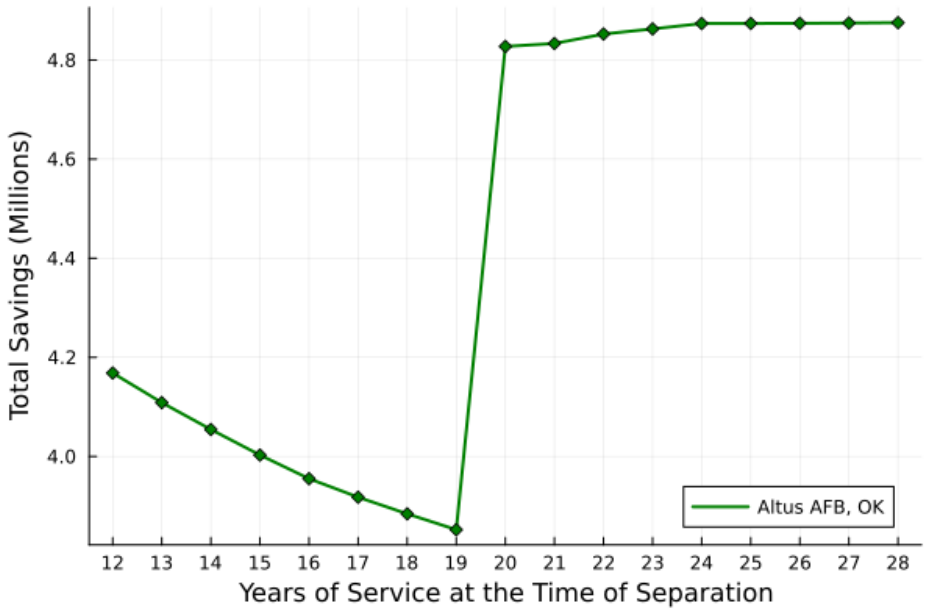

Figure D.16: The Impact of BAH on Savings at Retirement: Altus AFB, OK

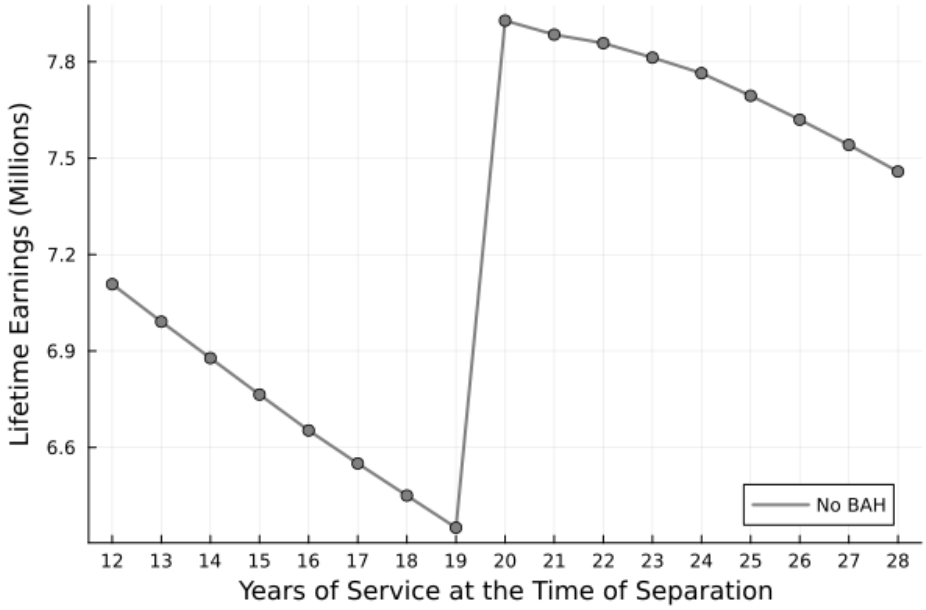

Figure D.17: The Impact of BAH on Lifetime Earnings: No BAH

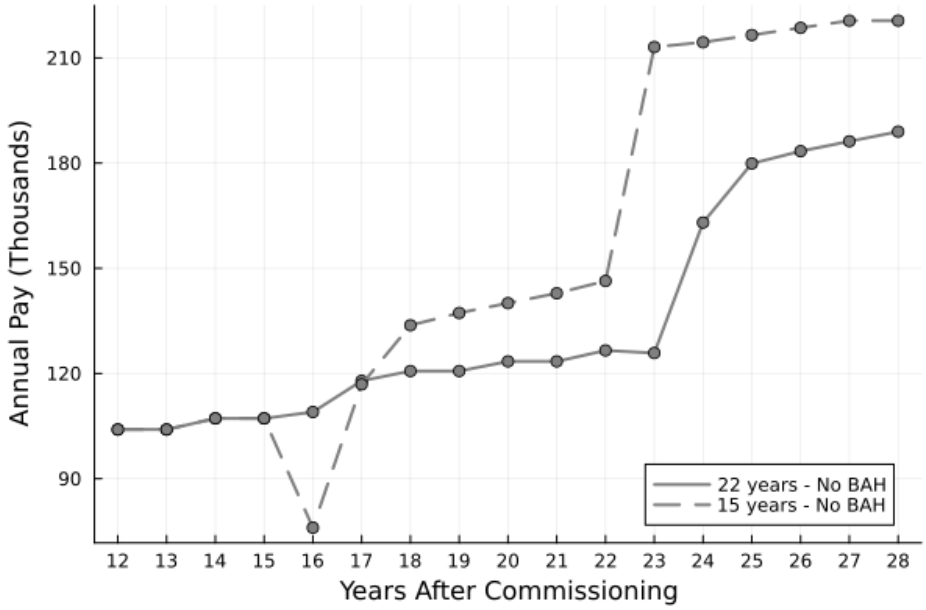

Figure D.18: The Impact of BAH on Annual Earnings: No BAH

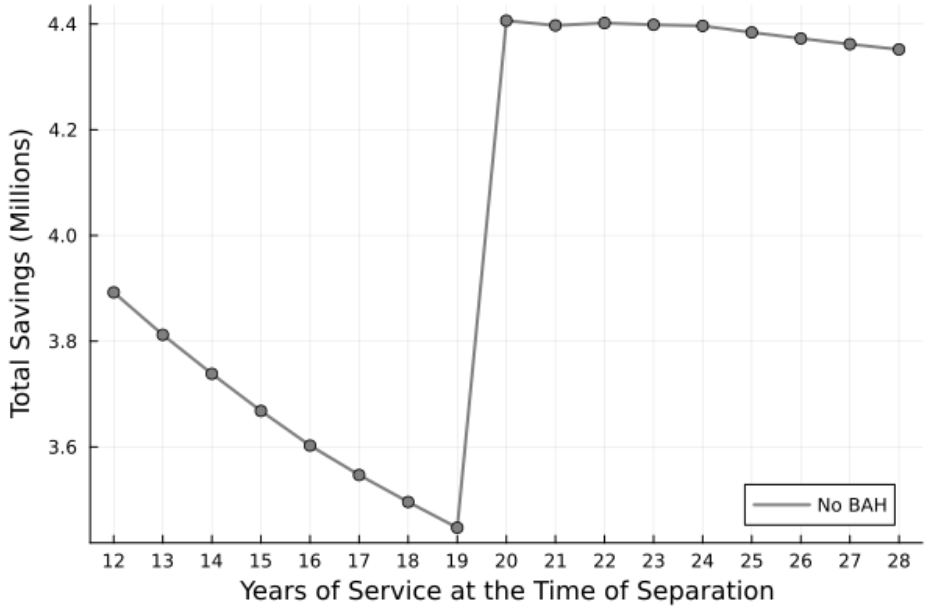

Figure D.19: The Impact of BAH on Savings at Retirement: No BAH

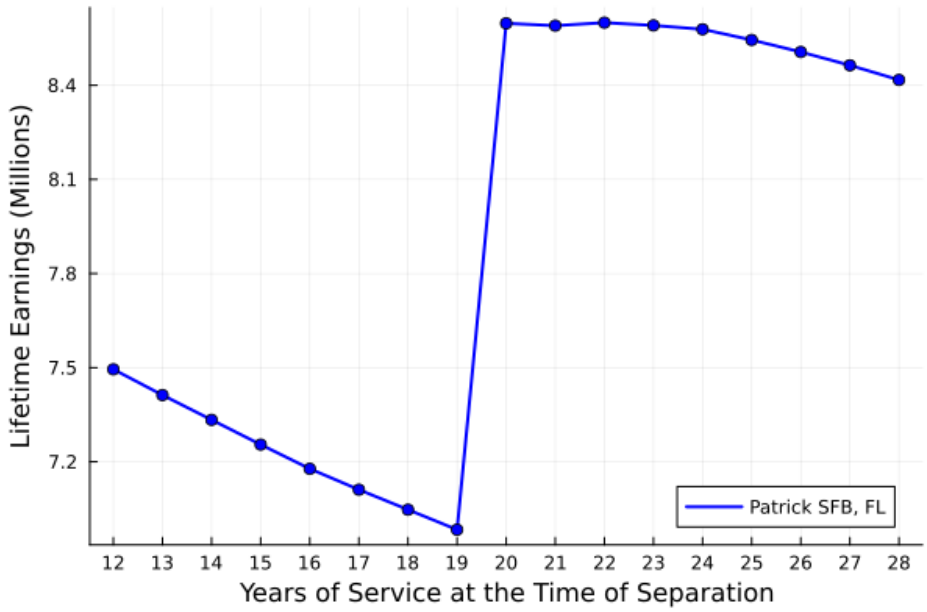

Figure D.20: The Impact of BAH on Lifetime Earnings: Patrick SFB, FL

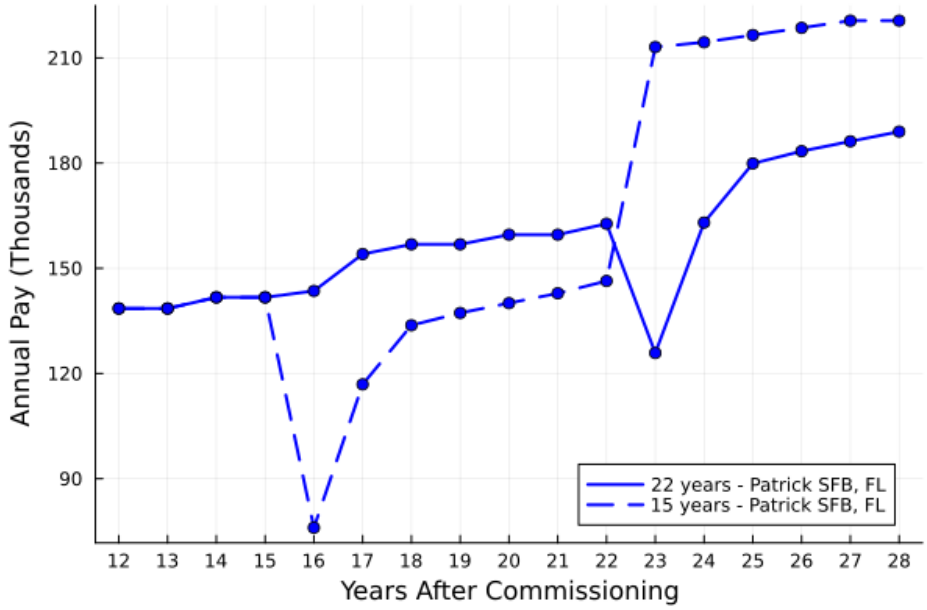

Figure D.21: The Impact of BAH on Annual Earnings: Patrick SFB, FL

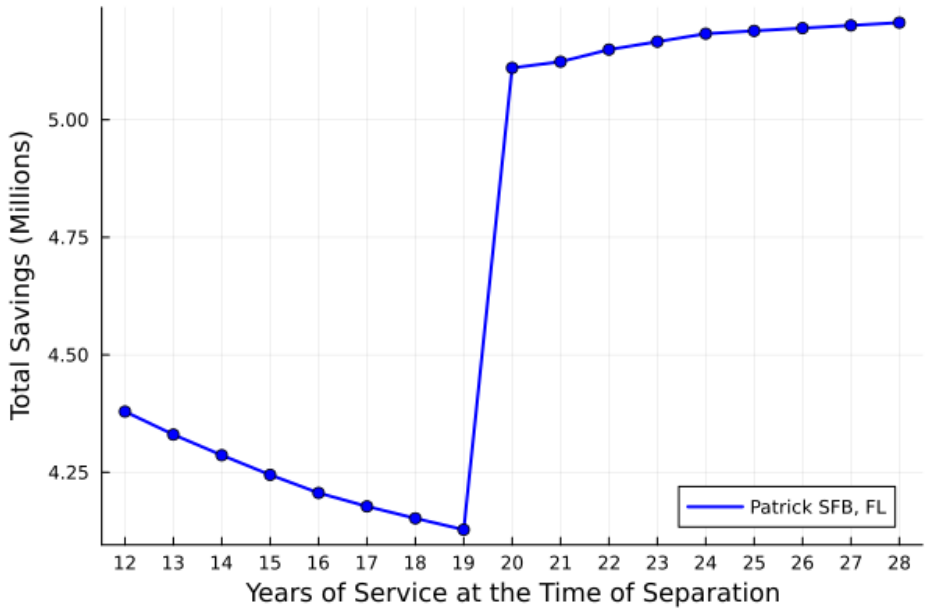

Figure D.22: The Impact of BAH on Savings at Retirement: Patrick SFB, FL

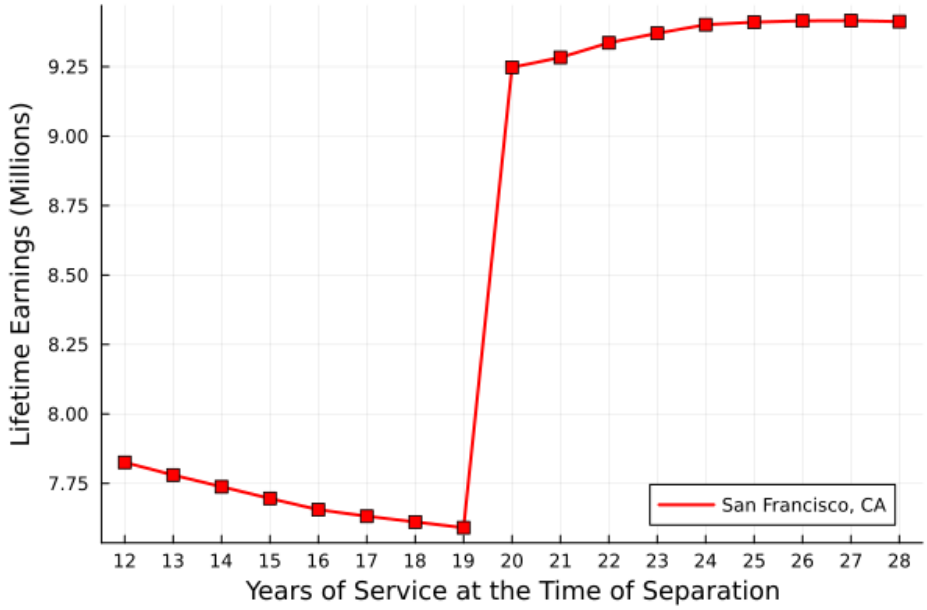

Figure D.23: The Impact of BAH on Lifetime Earnings: San Francisco, CA

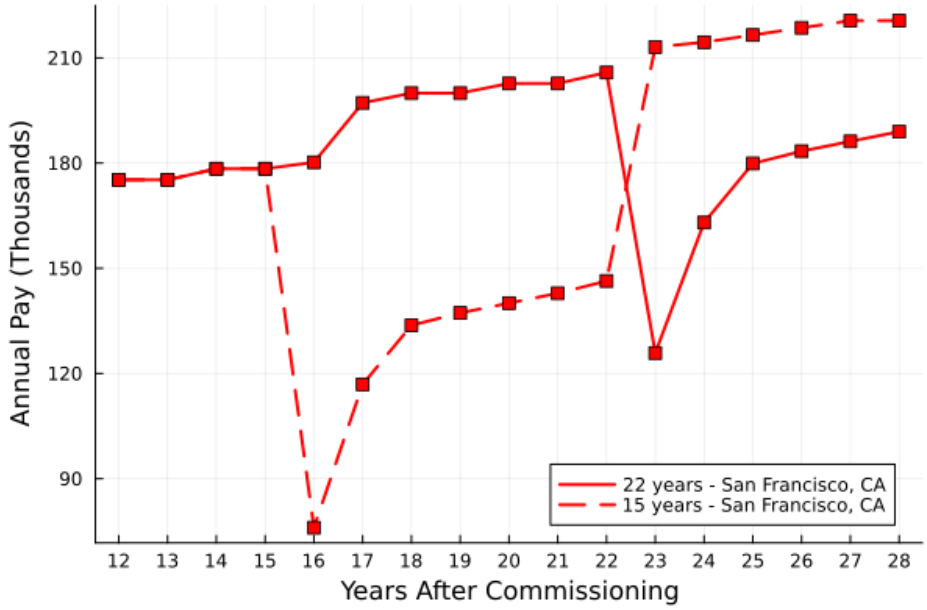

Figure D.24: The Impact of BAH on Annual Earnings: San Francisco, CA

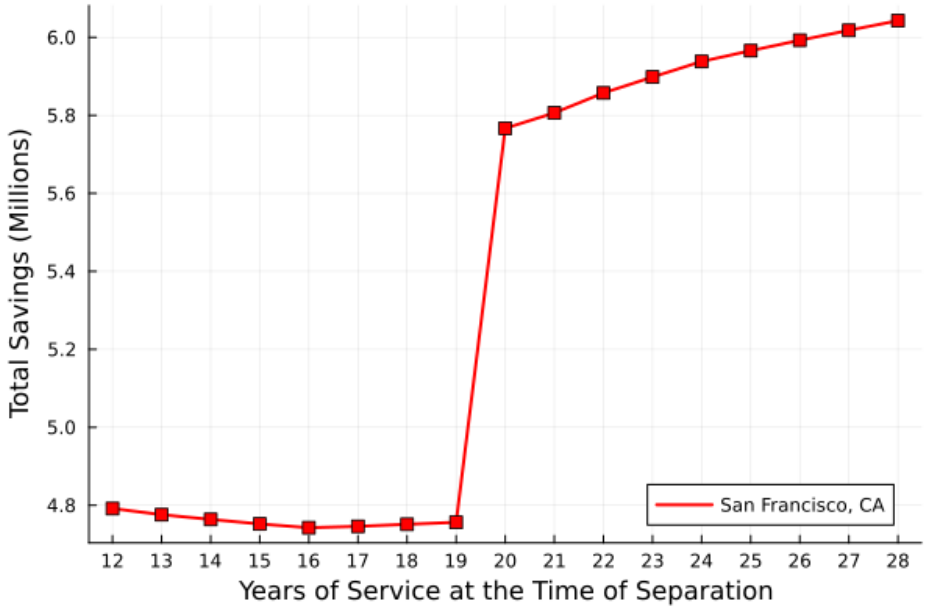

Figure D.25: The Impact of BAH on Savings at Retirement: San Francisco, CA

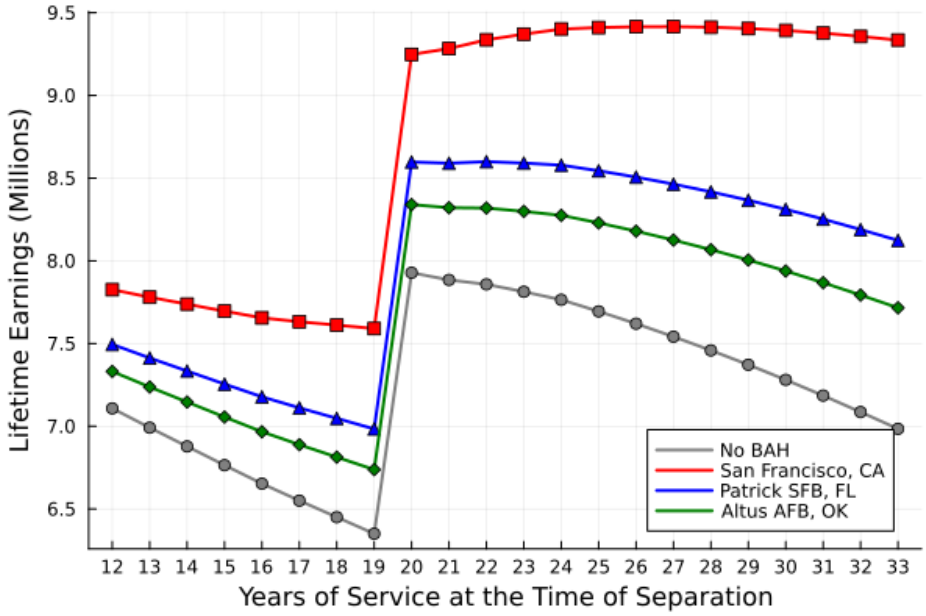

Figure D.26: The Impact of BAH on Lifetime Earnings

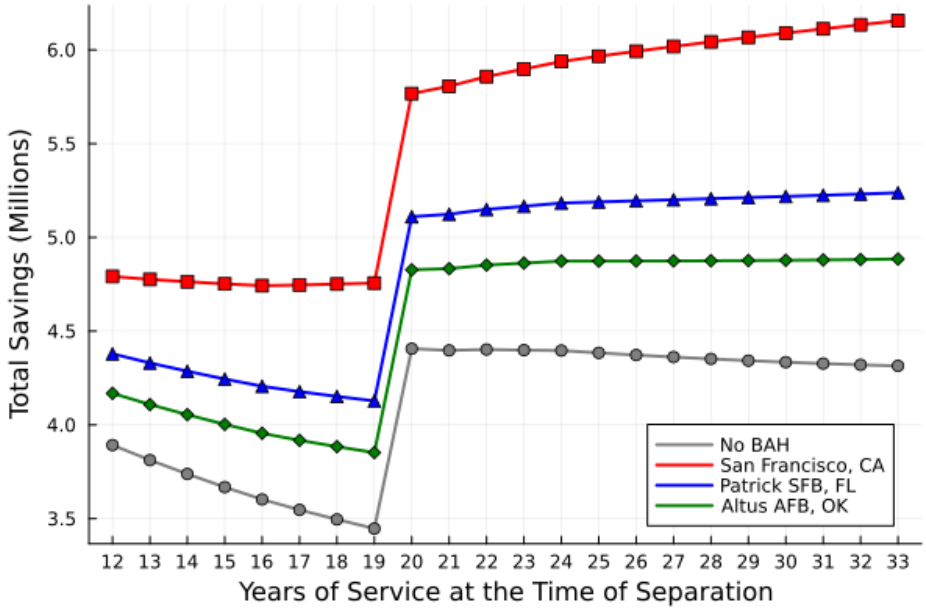

Figure D.27: The Impact of BAH on Savings at Retirement

that means that the individual is paying more for housing. A proper analysis for this may be to compare the hub where the individual pilot intends to work when he separates to work for an airline, and use the BAH for that area to "cancel out" the cost of living effects.

Marital Status Marital Status affects pay insofar as married pilots pay less taxes annually, and earn a higher BAH in the military, as can be seen in Figure D.28. In lifetime earnings, single pilots earn less, but their incentive structure is otherwise unchanged, as show in Figure D.30. The model result for total savings, seen in Figure D.30 yields a similar result, with unchanged separating incentives regardless of marital status.

Rate of Return Rate of return on investment, i is only analyzed in the savings at retirement model, as it does not affect lifetime earnings or annual earnings. Although increasing rate of returns increase a pilot's wealth, it does not affect the motivators for when to separate from the military prior to 20 years of service. After 20 years of service, it can change the incentives to stay in the military or separate, as seen in Figure D.31. Because market returns are unpredictable, and are largely correlated with airline hiring, a pilot may be incentivized to separate when returns are higher, as that is when he is more likely to get hired by an airline (**?**). A time period with higher returns could motivate a pilot to stay in the military to be able to continue to invest increased volumes of cash into the market at a sooner time. If a pilot knew how the market would act, he could make a highly informed separation decision to maximize his wealth, but

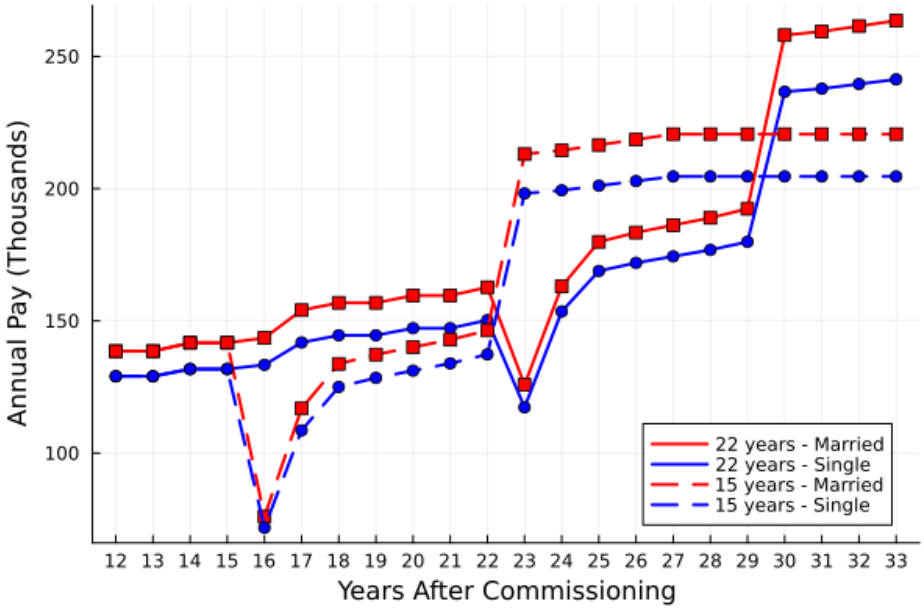

Figure D.28: The Impact of Marital Status on Annual Earnings

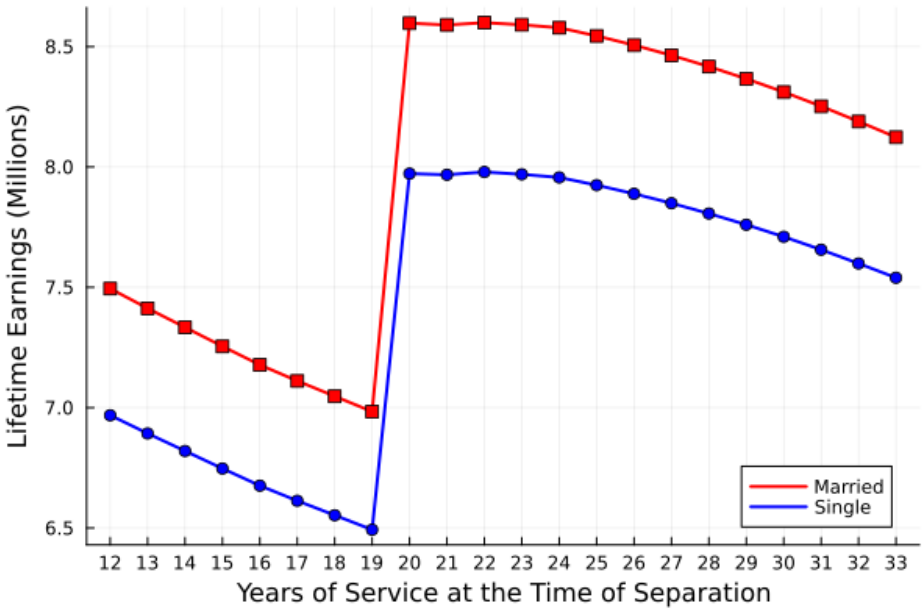

Figure D.29: The Impact of Marital Status on Lifetime Earnings

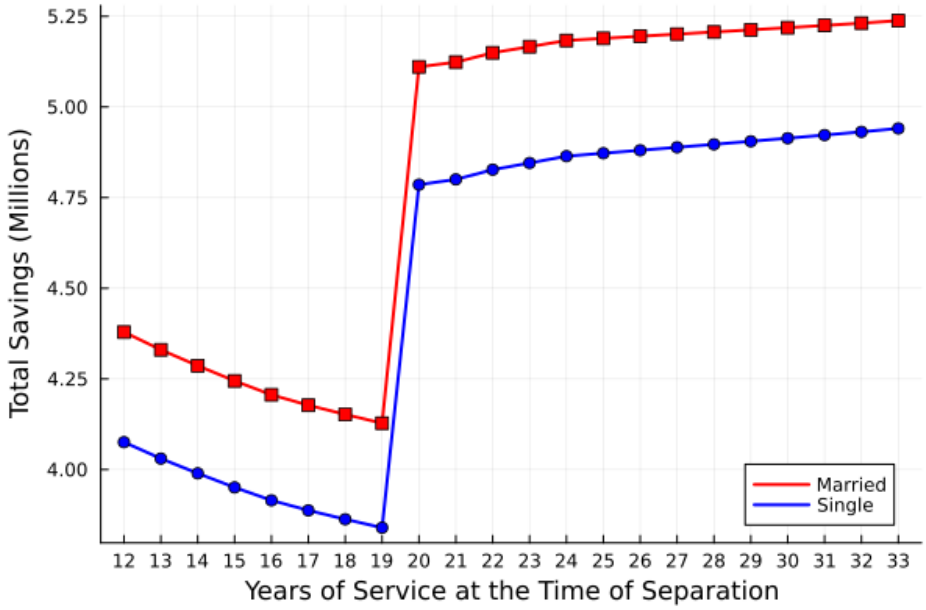

Figure D.30: The Impact of Marital Status on Savings at Retirement

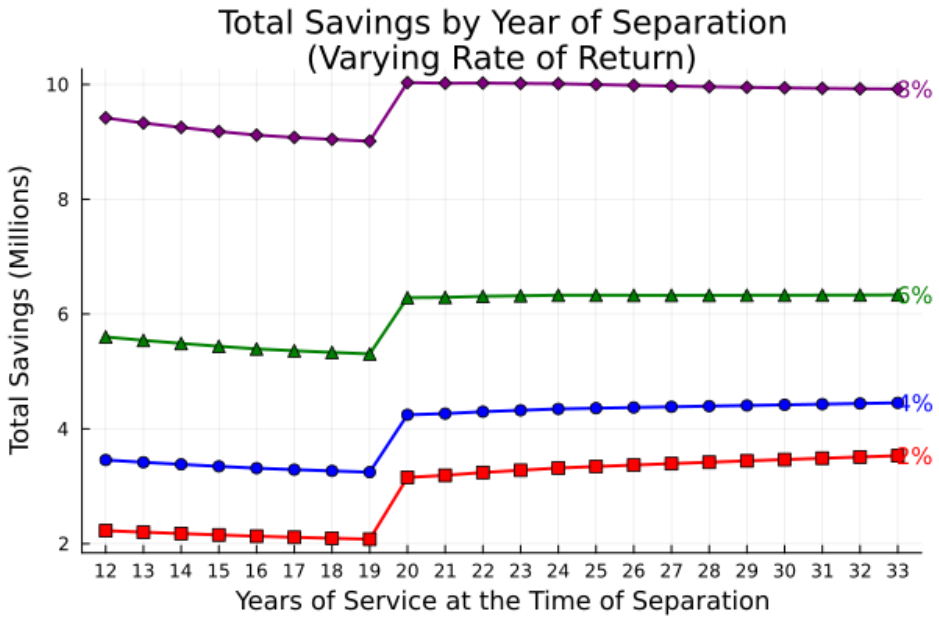

Figure D.31: The Impact of Annual Returns on Savings at Retirement

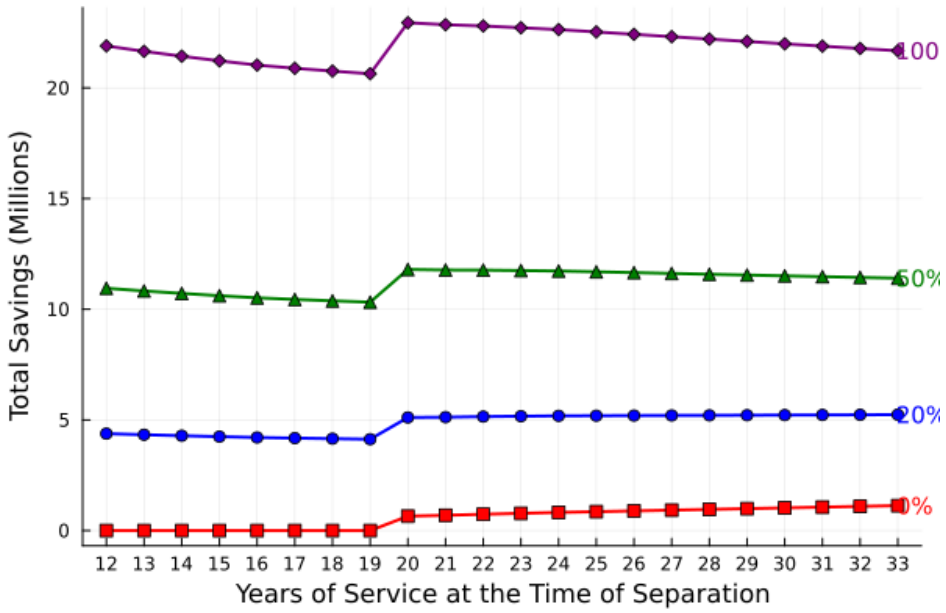

Figure D.32: The Impact of Annual Returns on Savings at Retirement

he cannot truly know this. When varying returns and promotion timing, one can see that a lower rate of return results in an increasing savings at retirement when choosing to stay in the military after 20 years of service, and a high rate of return results in decreasing savings at retirement for every year past 20 years that a pilot chooses to stay in the military. Regardless of rate of return, savings at retirement are decreasing in years of service prior to 20 years of service.

Savings Rate The Savings rate, k, indicates what proportion of annual earnings a person saves. A k of 100% indicates the maximum earnings a person could achieve by 65 years of age, if they were to save and invest everything they had earned. As shown in Figure D.32, as k increases, the slope of the line decreases, except for between 19 and 20 years of service, where the pilot secures a pension. In all other cases, however, the higher the savings rate, the greater the incentive is to separate from the military after 20 years of service. This means that the more of their earnings pilots save, the less they are incentivized to stay in the military. For someone who does not save any money, however, staying in the military is beneficial, as it increases the net present value of the pension at the time of retirement, which is included in savings. Holding all other variables constant, savings at retirement remains relatively constant in years of service when $k = 20\%$. Anything below that, and savings increase with time in service after 20 years, and anything above that and savings decrease with time in service after 20 years.

APPENDIX

E

DYNAMIC PROGRAM

The below formulations use the data from military and civilian airlines to build a dynamic programming model, which confirm the results found in this paper.

$$f(t)=\begin{cases} m(t)+f(t+1), & \text{stay} \\ \left[\sum_{n=1}^{65-(a+t)} c(t)+p(t)\right]+(LE-65)\cdot p(y), & \text{separate} \end{cases} \tag{E.1}$$

Figure E.1: Dynamic Programming Formulation to Maximize Lifetime Earnings

$$f(t)=\begin{cases} m(t)\cdot(1+i)^{65-t-a}+f(t+1), & \text{stay} \\ \left[\sum_{n=1}^{65-(a+t)}(c(t)+p(t))\cdot(1+i)^{65-n-a-t}\right]+p(y)\cdot\frac{(i+1)^n-1}{i(1+i)^{LE-65}}(1+i)^{LE-65-n}, & \text{separate} \end{cases} \tag{E.2}$$

Figure E.2: Dynamic Programming Formulation to Maximize Savings at Retirement